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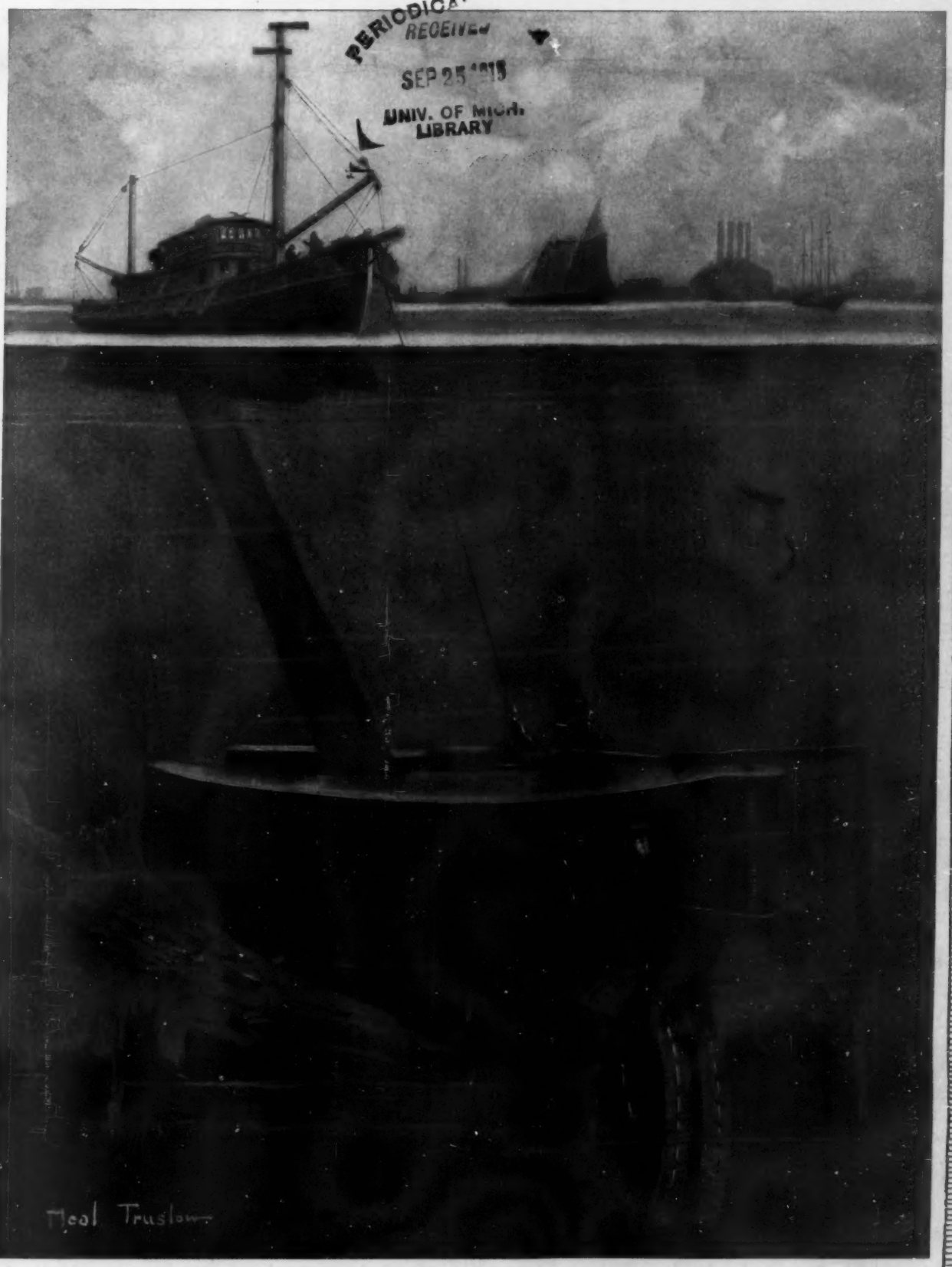


A SUBMARINE HYDROGRAPHER THAT MAKES ACCURATE DETAILED SURVEYS OF THE OCEAN'S BOTTOM.—[See page 272].

Vol. CXIII. No. 13
September 25, 1915

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents
$3.00 A Year

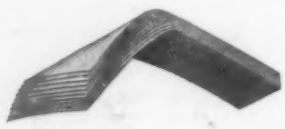
A Business Story

About Goodyear Laminated Tubes

Here are some facts, first told in print last spring, that increased Goodyear Inner Tube sales by 50% in one month. Which shows how many men are looking for surpassing Inner Tubes.

Many Tubes in One

Goodyear Laminated Tubes are not built of one thick piece of rubber. They are built of many thin layers vulcanized together. Note the picture.



In those thin layers, flaws and foreign matter are easily seen and eliminated. In a thick piece of rubber they often go undetected, resulting in leaky tubes.

We make our valve patch integral with the Tube, which prohibits leaking there. Thus we insure you a leak-proof Inner Tube.

14% Thicker Now

This year Goodyear Laminated Tubes are being made extra heavy. We have added an average of 14% more rubber. Yet we reduced our Tube prices by 20% when we reduced our tires. So Goodyear Laminated Tubes, extra thick, cost about the same as other Tubes today.

Never Colored

These Tubes are gray—the color of pure rubber. Mineral color would mean adulteration. And mineral in rubber increases friction heat—a Tube's worst enemy.

For these four reasons you should get these Tubes. Any Goodyear dealer will supply you. And their extra service, we are sure, will win you to Goodyear tires.

GOODYEAR
AKRON, OHIO
Laminated Tubes
Extra Heavy Tubes—Uncolored
Built Layer on Layer
By the Makers of Fortified Tires

THE GOODYEAR TIRE & RUBBER CO., Akron, O.

(2649)

SCIENTIFIC AMERICAN

Electrical Number

December 4th, 1915

A GREAT electrical movement is planned by the united electrical interests of this country, for the week ending December 4th, when the nation will pause to consider its debt to that magic force which turns our night into day, which carries our voice across the continent, which transports the energy of the remote mountain stream to the busy mill wheels a hundred miles away.

During this Electrical Prosperity week the SCIENTIFIC AMERICAN will publish a special electrical number which will be of unusual value to all who are interested in our marvelous electrical progress.

Some of the foremost electrical engineers of the country will contribute.

There will be articles dealing with present day marvels and pointing toward future advancement in the uses of electricity.

In addition to this special attention to electrical matters, the number will contain articles on the great European War and the scientific and technical progress of the day.

MUNN & COMPANY, Inc.
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SEVENTY-FIRST YEAR

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THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXIII. NUMBER 13

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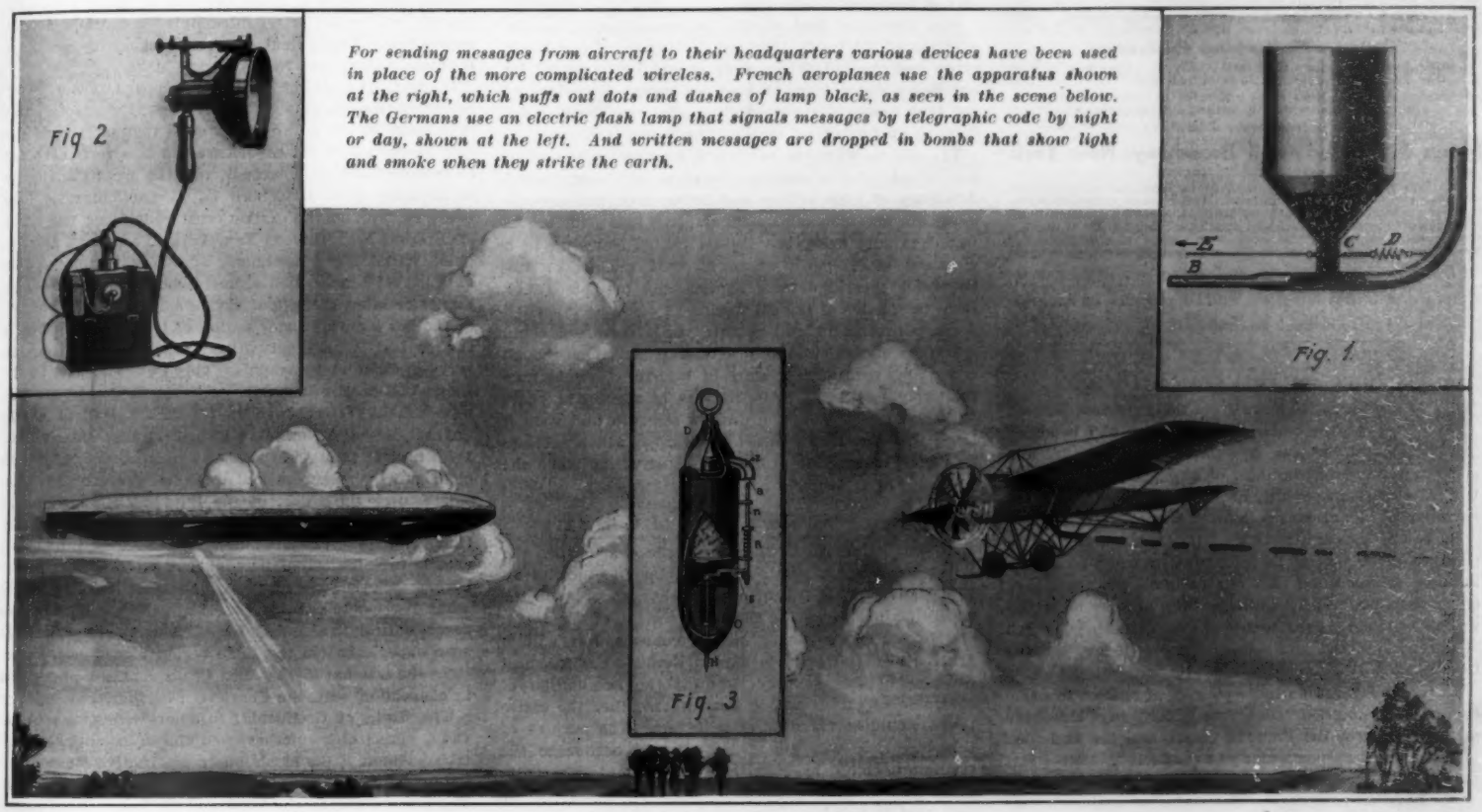

Signaling apparatus used by airships.

Signaling Apparatus Used by Airships

IN considering means of signaling from airships one's first thought would be to turn to wireless telegraphy, but on account of the many troubles experienced with same, it became necessary to search for some other and more practical means for communication with the observation stations.

For the last two years the French airships are using the "Means" method, a sketch of which is shown on Fig. 1.

A cylinder having a capacity of about five gallons is filled with lamp-black. The bottom is connected with the exhaust-pipe *B* and the connection between is provided with valve *C*, kept in closed position by a spiral spring *D*. By pulling on cord *E* the valve opens and a part of the lamp-black is blown out by the exhaust from the motor and produces a dark streak in the atmosphere. A shorter or longer opening of the valve produces a streak of corresponding length, and the signs produced are in accordance with the Morse code. These black streaks are plainly visible from a distance of about six miles, and remain visible for two minutes even in windy weather.

The advantage of this method is that the enemy cannot interfere with the given signals, as he might do so by disturbing the waves of the wireless telegraphy, by producing quiescent currents. Its disadvantage is that its use is limited to the period of daylight; and furthermore because the aviator himself cannot receive any messages from the fixed stations.

The Germans did not adopt this method, but are using a more practical system invented by the German scientist, Donath. The apparatus is shown on Fig. 2, and consists of a searchlight, in the focus of which a powerful "Ozram" electric lamp is placed. The current is supplied by seven storage batteries placed in a suitable metal casing that may be turned upside-down without losing a drop of the fluid. The current raises the temperature of the filament of the electric lamp to nearly its melting point, about 2,800 deg. Cent. = about 5,072 deg. Fahr., the small lamp producing 10,000 candlepower. The lamp lasts under this condition only 40 to 50 hours, but this is sufficient for the purposes of the aviator. The handle of the lamp is provided with a small button switch that regulates the period of the light in accordance with the signs of a telegraphic code. A telescope is mounted on top of the light, by means of which the aviator locates the station he desires to communicate with. The receiving station has the same kind of apparatus. The searchlight is so constructed that it does not throw the rays of more than 2 to 3 degrees. The weight of the complete apparatus is 2 pounds, and including its storage batteries not more than 11 pounds.

The efficiency was tested on the Johannis-Thaal aviation grounds, and it was found that at night signals could be sent a distance of 10 miles, and in the brightest daylight signals could be distinguished over five miles.

For sending written communications, etc., letter bombs are used, Fig. 3. The bottom *O* of the cylinder in which the letters are placed is filled with lead. Cover *D* contains easily ignitable material burning with a high flame, and producing intense smoke. The heavy lead keeps the falling bomb in vertical position, and pin *H* reaches the ground first, and is pushed in. Lever *S* releases rod *n*, which through the force of the spiral spring *R*, hits the igniting cup *a* and through fuse *z* ignites the contents of *D*. The flame and smoke are easily visible from a distance of several hundred yards.

Thermometry of Low Temperatures

THERE is an interesting article on the thermometers used for finding low temperatures in the Supplement to a late number of the German journal *Prometheus*. This says that Kelvin's thermodynamic scale is taken as the fundamental scale for low temperatures. The scale is divided into degrees corresponding to those of the Celsius thermometer, but starts from absolute zero. The fixed points are exactly defined; the pressure is based on the international atmosphere, that is, 760: 1.0003322 millimeters Hg.

"The hydrogen thermometer," continues the writer, "is ordinarily used for measuring the lower temperatures. As, however, hydrogen becomes solid at the temperature of liquid helium, temperature is measured in such cases by using helium, the most difficult gas to liquify. Under normal pressure this gas also liquifies at about 2 degrees, and the pressure has to be reduced in order to be able to determine the lowest temperature."

The position of absolute zero is determined by extrapolation according to Avogadro's method. The researches of Berthelot and Kamerlingh Onnes show that absolute zero is —273.09 deg. Cent. These investigators state that the Kelvin international scale is the one which takes this temperature as zero. In making measurements near absolute zero the differences between this scale and Kelvin's absolute scale should be added as corrections.

The variations of hydrogen and helium from the complete gaseous form at low temperatures also require corrections. The measurement of very low temperatures means the measurement of a very low gas pressure of helium, and for this the most suitable instrument is Knudsen's hot wire manometer. The lowest temperature attained up to now (1.15 deg. K.) corresponds to a steam pressure of 0.2 millimeter.

The difference between the international helium thermometer and Kelvin's absolute scale is very small since Kamerlingh Onnes and Keesom introduced into the theory an energy of the advancing movement which is said to apply also to absolute zero. Among the temperatures difficult to determine are the heat of evaporation, the Joule-Kelvin effect, and specific heat.

"It is often easier," continues our writer, "to measure the lower temperatures by an auxiliary thermometer than by a helium-gas thermometer. Suitable for this purpose are the methods based on the measurement of steam-pressure, while the thermo-electric measurements of temperature are not suitable, as the thermopowers become too slight at low temperatures. Partial service can be given by the couple gold-silver; electric resistance thermometers are well suited for exact measurement of very small differences of temperature within narrow ranges."

Almost all pure metals lose practically the coefficient of resistance at very low temperatures and often the resistance as well. Only an alloy, manganin, shows a coefficient of resistance at the lower temperatures, although it hardly retains this down to the temperature of liquid hydrogen. Most of the other metals are suitable for nearly all ranges of temperature, and all resistance thermometers must be tested individually, for very large deviations are conditioned on very small intermixtures, and these deviations grow larger the lower the temperatures.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contribution will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Navy Our First Line of Defense

IT is reassuring to learn from the President himself that during the coming Congress he will bend his energies to the task of building up our naval and military forces to a standard of strength commensurate with the size and wealth of the country and the importance of its national policies.

As to the size and wealth of the country, it is sufficient to point to the fact that we number some one hundred millions and that our national wealth is over one hundred and fifty billions, fifty billions of which wealth is found on the seaboard and within easy reach of an enemy's fleet and a hostile expeditionary landing force.

As to our avowed national policies, it suffices to name the Monroe doctrine, the "open door" in China, the neutralization of the Panama Canal, and the exclusion of the Asiatics, particularly as affecting that great and rapidly growing naval and military power, Japan.

We have so recently, in the series of articles, "Our Country, an Undefended Treasure Land," laid down the lines along which, as a minimum, our military forces should be increased, that it is sufficient to refer to our issues in which they appeared.

It is to the United States Navy, as our first line of defense, that we now direct attention. If our Navy be restored to the rank of second in relative strength among the navies of the world, which it held in 1905, the United States need stand in little fear of invasion. Great Britain, of course, will ever remain the dominant naval power; but war with her is unthinkable.

The Spanish war opened the eyes of the United States Congress to the controlling influence of sea power, and the country and its Congress, under the dominating influence of a strong and popular President, set about the task of creating a navy commensurate with the needs of the United States, with such zeal that in the brief period of half a dozen years, we had risen to that position of second naval power, which should be ours to-day. In the interval between 1898 and 1904-05 Congress appropriated so liberally for the Navy that the average addition to the Navy was four armored ships per year.

Since 1905 we have neglected the Navy to such an extent that the average number of armored ships added to the Navy has fallen from four to one and one half annually. Hence, to-day, we stand fourth in total tonnage and rank as a third-class power in the strength of our first or dreadnought line.

There is but one first-class navy, the British, with some forty dreadnoughts; there is but one second-class navy, the German, with twenty-two dreadnoughts; and there are three third-class navies (reckoned in terms of dreadnoughts) the United States with ten dreadnoughts, and the French and Japanese, whose dreadnought line is at present smaller in numbers, but is rapidly overtaking our own.

President Wilson has the opportunity—by virtue of the strong confidence of the public and his remarkable control of Congress—to restore our Navy to that proud and proper rank to which President Roosevelt had brought it in 1905. If this is to be done it should be done with all possible expedition; and, by utilizing the full shipbuilding resources, both of the navy yards and the yards of the private shipbuilding firms, it would be possible to carry our navy up to the second rank not long after, and possibly by the close of the present European war.

To-day we have fourteen dreadnoughts built and building. Congress should authorize the immediate construction of six 33,000-ton, 28-knot battle-cruisers, each carrying eight of the new type 16-inch gun. On 33,000 tons it would be possible to give these ships 12 inches of protection on belt and gun positions

As a fast wing of the fleet and for breaking through the cruiser screen of the enemy they would be unrivaled, and they could "lie in the line" against any ships that are afloat to-day.

Also, the forthcoming Congress should authorize the construction of a dozen 5,000-ton, 30-knot scouts, of the British "Arethusa" class, mounting a heavy battery of 50-caliber 5-inch guns.

Our destroyer fleet should be strengthened by the addition of thirty-six 1,000-ton destroyers of our latest type; and the submarine fleet should be increased by building a dozen large 20-knot sea-going submarines of the type now under construction, and two dozen coast defense submarines of smaller displacement.

The above, with the necessary increase in the numbers of our officers and men, to make good our present deficiency of 1,000 officers and 20,000 men, and provide crews for the new ships as they come into commission, would rapidly bring the United States Navy up to a standard of strength, where it could present an unbreakable line of defense against any possible attack from the navies of the old world.

Our Government and private yards combined could take care of this building programme, ambitious though it is; and with such a start in 1915-16, it would take relatively moderate appropriations in successive years to bring the Navy to the desired strength and keep it there in the years to come; for Europe will be able to spare but little money for naval construction when the present war is over.

The New Advisory Board of Our Navy

THE announcement, a few weeks ago, that the Secretary of the Navy was about to appoint an advisory board of civilians to pass upon the merits of inventions for the improvement of the Navy, and to confer on various naval problems, met with a great deal of adverse criticism. Because the foremost inventor of this country accepted the nomination of chairman of this board, it was inferred that the entire board would be made up of inventors. The purpose of this board, it was announced, was to encourage the civilian inventor by furnishing a court of experts to examine his invention, which would be free from the bias that is popularly attributed to military and naval men. So far from reassuring the inventor, however, this assumption that the board was to be made up of inventors, tended rather to increase his distrust; for the last person an inventor would go to for an impartial estimate of his invention would be another inventor engaged in the same class of work.

Curiously enough the announcement of the names of the rest of the board last week was attended by a different order of criticism. This time the plaint was that most of the board are not inventors; in fact, very few are known by the public at large for important inventive work. The criticism, however, comes from those who look upon this as a board of inventors instead of a board of consulting engineers. Their primary task is not personally to originate new apparatus, but to inspect and advise the adoption of ideas and materials furnished by others.

The nomination of these twenty-two members was made by eleven of the principal scientific societies of the country; each society chose two representative members by ballot, and although many of them are not popularly known, they were undoubtedly chosen for their special qualifications, as the best that each society could offer from its own membership. We recognize among them many who may not have produced any very striking original work, but who have been trained to take the work of others and adapt it to practical use. Most of the members are engineers, and while every successful engineer must be imaginative and to that extent endowed with creative faculties, his training is such as to enable them to weigh the merits of another man's inventions and utilize it to the best advantage.

The *personnel* of the board will be found on another page.

Earthquake Dangers in the United States

TO the mind of the average American the word "earthquake" suggests an interesting but uncomfortable contingency to which Japan and certain other very distant countries are more or less subject. This complacent attitude of mind was temporarily disturbed in the spring of 1906, when the city of San Francisco was laid in ruins by one of these visitations, just as it had been disturbed twenty years previously by a similar occurrence at Charleston, S. C.; but the impression produced by such disasters, except upon the actual sufferers, seems to be rather transient. The best proof of this is seen in the fact that the United States Government, which spends far more money than any other government in the world on scientific investigations, has never, until within the last few months, inaugurated any systematic study of earthquakes.

Just how common are earthquakes in this country? It will not be possible to answer this question fully until many years hence, when substantial progress shall have been made in the "earthquake survey" which has just been undertaken by the Weather Bureau. Unofficial investigations have, however, revealed the fact that certain sections of the country are decidedly "seismic," i. e., subject to earthquake shocks. One of these is New England, where mild earthquakes have frequently occurred, and where a disastrous one at some indefinite time in the future is regarded by seismologists as not improbable. Two points of special seismisity are East Haddam, Conn., and Newburyport, Mass.

In fact, the whole Atlantic seaboard, from Nova Scotia to Georgia, has certain geological characteristics that mark it out as an earthquake region, though the only severe shock yet experienced in this region, so far as definite knowledge extends, was the great Charleston earthquake of 1886. There is, in particular, a long break or fault in the earth's crust connecting the cities of Boston, New Haven, New York, Trenton, Philadelphia, Wilmington, Baltimore, and Washington, known as the Fall Line, which seems rather liable to become, sooner or later, the site of severe earthquake shocks.

Another known seismic region of the United States is the central Mississippi valley, especially the portion between Cairo and Memphis. This was the scene in the years 1811-1812 of a series of very violent upheavals, now usually referred to as the "New Madrid earthquake." Between December 16th, 1811, and March 16th, 1812, no less than 1,874 shocks were recorded, of which eight were very severe and were felt more or less distinctly over the whole of the then settled portions of the United States. This earthquake produced important geographic changes; new islands came into existence in the Mississippi, new lakes were formed in neighboring valleys (one of them 100 miles long), and old lakes disappeared. Strangest of all, the earthquake has never entirely subsided, for slight after-shocks have been experienced in the same region almost every year since the original disturbance (a phenomenon also noted in connection with the Charleston earthquake).

The State of California, together with western Nevada, constitutes another well-known earthquake district. About a dozen seriously destructive shocks and hundreds of light ones have been recorded in this region. The Great Basin in the West and the lower Great Lakes have also been the scenes of occasional earthquakes.

About fifty seismographs are now in operation in the United States. Most of the shocks registered by these instruments are so light as to be imperceptible to the human senses. In order to obtain detailed information concerning the occasional more severe earthquakes, the Weather Bureau has enlisted a corps of several thousand volunteer observers who are instructed to make regular reports of any shocks that may come to their notice. As to the *raison d'être* of this undertaking, the Bureau says, in a recent circular: "To confine attention to the obviously and eminently practical, we should know the exact locations of those numerous breaks and weak vertical seams in the earth's crust along which abrupt slipping and sliding (the cause of nearly all earthquakes) most frequently occur, so that, as far as possible, we may avoid them in the location of such permanent structures as dams, irrigation channels, aqueducts, bridges, and even ordinary houses. In spite of the good it clearly would serve, there is, however, no map of any country that gives at all fully the locations of earthquake breaks or faults, nor is the collection of the data essential to the construction of such a map of any extensive section possible, except through the long and constant co-operation of a large number of observers widely scattered over the area in question."

The work of mapping the seismic regions of the country does not, however, exhaust the possibilities for purely practical achievements in earthquake investigation. The fact that certain districts are notoriously subject to earthquakes does not prevent them from being populated by human beings nor from becoming the site of structures liable to earthquake damage. In such regions, therefore, it is an important problem to determine what form of construction is best able to withstand earthquake shocks, and this can be done only through a careful study of such shocks and their effects. Of course the art of "earthquake construction" has already made some progress, mainly owing to the efforts of Japanese and Italian students, but the question is of universal interest, and Americans are bound to do their share toward its elucidation.

The definite prediction of earthquakes is not yet in sight. What the future will bring forth we cannot say, but we can at least feel sure that the more thoroughly and the more widely earthquakes are studied, the better this important desideratum will one day be realized.

Electricity

Red Electric Lamps and Mosquitoes.—According to a suburban resident of New York city, red glass or red dipped incandescent lamps do not attract mosquitoes in the way that the ordinary white light does. By installing low candlepower red lamps on porches where only general illumination is necessary, it is said that persons may enjoy comparative immunity from mosquitoes, just as if no lamps were used.

Electrically-operated Bait for Night Fishing.—Having noticed that certain game fish, particularly the bass and muskellunge, often contain glow worms and other phosphorescent insects, an inventor has devised an unique electrically-illuminated bait for either deep-water trolling or night fishing. The bait is made of celluloid, in the form of a minnow, and containing a miniature electric lamp which is supplied with current through fine copper wires carried along the fish line. The light may be flashed on or off by means of a push button, making the bait resemble a glow worm if desired.

Solution of the Electric Sign Problem.—A western power company maintained a patrol system for turning off the electric signs and window lamps in the business section of a city for many years, but the system is claimed to have been unsatisfactory to both the company and its patrons. A novel solution of the problem was recently arrived at by the placing of all the signs on a separate circuit so that the lamps could be controlled from the power house. By an agreement between the company and the consumers, all the lamps are extinguished at 11:30 each night.

An Electrically-Operated Zeppelin Alarm.—An English inventor has devised a warning signal that is intended for use in all homes supplied with electric current and to advise the inhabitants of the approach of Zeppelins or other hostile aircraft. The alarm depends for its operation on the shutting off of the electric current supplied by the local power house, upon the approach of the aerial invaders. The interruption of the current causes a bell on the alarm to ring as well as to throw on a battery lamp. The householder thus warned can shut off the bell by means of a switch and take any other precautions that may be necessary. The battery lamp furnishes dim illumination during the actual or attempted attacks.

Meteorology and Wireless Waves.—It is a recognized fact that the strength of electric waves which are produced by radio-telegraphic stations varies not only at different hours of the day, but also at various epochs of the year. But as to the precise effect of meteorological or other conditions upon electric waves, there is as yet but little information of any reliable character to be had. M. Mosler, a German scientist, brings out some interesting data on this subject in a series of careful observations made day and night for a year upon the strength of electric waves. Stationed at a post which received signals from a second one at 250 miles distance toward the west, he measured the strength of the waves by detector and galvanometer. He finds that during the day the strength is not affected by the light of the sun, and this strength is remarkably constant all the year round. But he finds that the strength rises to points of maximum value during nights in autumn and spring. Such maxima are also seen in summer. Waves cannot be transmitted to longer distances at night than in daytime during the season of the greatest cold, in general. During the night he remarks great increases in strength, which rapidly diminish, and these seem to be due to changes in ionization of the upper atmosphere. In spite of the closest observation, he was unable to discover that the moon had any effect upon the strength of electric waves.

Drainage of Polders by Electric Motors.—Within a recent period, electric motors have been coming into use in Holland for operating pumps for drainage of polders, or marsh land, shallow lakes and other areas where water prevails. It is of advantage to reclaim this land on account of its fertility and thus large tracts can be recovered, but the pumping work requires constant attention. At first, windmills were used for this purpose, then at later periods steam engines were employed or more recently, internal combustion engines. But since the development of electricity in Holland, electric motors are found very advantageous for this class of pumping work and are now coming into good use. Among others, we may mention two large electric stations located at Raamsdonk and Dussen, which supply alternating current at 3,000 volts for numerous motor-pump drainage outfits. At present, such machines are in use on 32 and 21 polders, respectively, from these two electric plants. Each polder has erected a drainage station containing a centrifugal pump which is operated automatically by a good-sized electric motor. Suitable devices act to switch the current on and off the motor according to whether the water level rises or descends, so that the water is kept pumped out to the standard level for drainage of the ground. In this way the polders are kept dry. There are also in use seven communal electric plants for the same use.

Astronomy

Nebula Mistaken for a Comet.—A bulletin from Harvard College Observatory announces that a telegram received from Prof. E. B. Frost, of the Yerkes Observatory, states that the supposed comet, announced as having been discovered by Mellish on September 6th, proves to be Herschel's Nebula 399, Dreyer 2,261.

A Stolen Telescope.—The astronomical observatory of Pomona College, Claremont, Cal., enjoys the unique distinction of having had its telescope stolen. Although the instrument, a six-inch equatorial refractor, was not carried off bodily, the essential parts were taken: viz, the objective, the finder and one eye-piece, besides the brass cap belonging to the objective and the tube in which the eye-piece slides.

The Height of Jupiter's Atmosphere.—In the *Bulletin* of the Astronomical Society of Barcelona, Señor Vicente Ventosa y Martinez de Velasco publishes a belated account of an observation of an unpredicted occultation of the brighter component of Beta Scorpii, which he secured on February 27th, 1876. The variation in the brightness of the star as it left the limb of the planet leads Senor Ventosa to estimate the height of the Jovian atmosphere at 2,500 to 3,000 kilometers (1,500 to 1,800 miles).

The August Meteors.—Writing in *Nature* of the last display of Perseids, as observed in England, Mr. Denning, the well-known authority on meteors, states that these bodies exhibited a distinct difference in velocity, apart from what might be induced by differences in position and distance. "Two meteors appearing in very nearly the same region gave in several instances an apparent speed essentially dissimilar, though presumably at the same height or very nearly so."

Idle Observatories.—In his presidential address at the last meeting of the South African Association for the Advancement of Science, Mr. R. T. A. Innes called attention to the large number of astronomical observatories, some of them admirably equipped, which are doing little or no work, beyond, perhaps, maintaining a time service or meteorological service of local importance. He stated that "at least two of the observatories possessing exceptionally large refracting telescopes have not contributed one month's work from them in the last twenty years." At least 33 per cent of the observatories listed in the British Nautical Almanac publish nothing.

A Lost Star.—In a recent communication to *l'Astronomie*, M. Raymond, of Antibes, reported that he was no longer able to see the companion of Alpha Cancri, which he had previously observed, and asked to have his observation verified at institutions equipped with large telescopes. The object has since been sought in vain with the 31.5 reflector of the Observatory of Marseilles. It will be interesting to learn whether still more powerful telescopes can detect it. The companion in question has heretofore been described as a star of the eleventh or twelfth magnitude, distant about eleven seconds from the primary. M. Raymond also notes an apparent change of color between the time the binary was first observed by Herschel, in 1820, and his own observations of 1909 and 1910.

Astronomy in the Public Libraries.—The Astronomical Society of Pomona College recently sent a questionnaire to sixty public libraries in the southern part of California for the purpose of ascertaining to what extent astronomical books and periodicals were represented in their collections, how much use was made of such literature by the public, and whether any attempt was being made by the libraries to stimulate interest in astronomy. Thirty-seven replies were received, and these showed an average of 2.15 astronomical works to every 1,000 volumes in the libraries. Less complete returns show that among scientific books in the libraries 12 per cent are astronomical. The most striking result of the inquiry is the discovery that astronomical periodicals are received in very few libraries, and none receive more than two. Seven libraries report that the astronomical notes in the SCIENTIFIC AMERICAN are the only periodical literature they receive in any forn. Only five or six libraries are making any effort to interest their readers in astronomy.

The Atmospheric Conditions Favorable for Astronomical Observations have been rather frequently discussed of late in the astronomical journals. A paper on this subject, by Mr. Evershed, of the Kodaikanal Observatory, has just been published by the Astronomical Society of the Pacific. The author calls attention to "the urgent necessity of further research in order to discover the best possible sites for future observatories," and expresses the belief that "vastly better conditions are actually available than those which have hitherto been considered the best." The writer deals with the subject of definition, rather than that of clear skies, and emphasizes the fact that good definition depends upon uniformity of temperature conditions and hence the absence of strong convection currents. The proximity of large bodies of water favors an equable temperature, and a small oceanic island, in a latitude where clear skies are prevalent, appears to be the ideal site for an astronomical observatory.

Science

The Russian Prisoners of War in Austria are to be made the subject of anthropological researches conducted by Prof. R. Poech, with the aid of a grant from the Vienna Academy of Sciences.

German University Students in the War.—According to the *Akademische Rundschau*, no less than 84 per cent of the students of the University of Königsberg have gone to the front. The percentages from certain other universities are: Heidelberg, 60; Munich, 56; Berlin, 54; Frankfurt, 11. The Technische Hochschule of Danzig has sent 90 per cent of its students to war. German professors and students killed up to the end of May numbered 1911, of whom 266 were from the University of Leipzig.

A Test for Platinum Ware.—The Bureau of Standards announces that, at the suggestion of a committee of the American Chemical Society, it has recently carried out an experimental study of the quality and purity of platinum utensils, such as crucibles, wire gauze, dishes, etc. In this connection the Bureau has devised a delicate thermoelectric test for platinum purity, permitting a rapid estimate of the amount of included foreign matter. This test, which does not injure the objects tested, is being generally adopted by large purchasers of platinum ware.

Geological Survey Guide Books.—The transcontinental guide books of the U. S. Geological Survey, the first of which, "The Overland Route," was published in June, represent an interesting development in the varied publishing activities of the Survey, belonging in a sense to the same category as the excellent guides which have been issued to the various national parks. While called forth especially by the expositions in California, these works will be of permanent value to travelers. The series of transcontinental guides will include four volumes; viz, "Northern Pacific Route," "Overland Route," "Santa Fé Route," and "Shasta Route and Coast Line."

Volcanoes and Climate.—The effects of volcanic dust upon climate have formed the subject of numerous publications during the last few years, the more noteworthy being those of Abbot and Fowle, and Humphreys. The subject has now been taken up anew by Dr. H. Arctowski, well known for his researches on so-called "pleionian" variations of temperature and other atmospheric conditions. He finds that the dust veil produced by the Krakatoa eruption affected atmospheric temperatures very greatly, while the violent eruptions of 1902, as well as the Katmai eruption of 1912, influenced the yearly mean temperatures but very slightly, or not at all. The pleionian variations of temperature have nothing in common with the presence or absence of volcanic dust, but an influence of the sunspot variation upon the changes of atmospheric temperature is undeniable.

Edible Snails in the United States.—Snail culture apparently has not yet made a beginning in this country, the few snails found on the market here being brought over from Europe alive in barrels and casks and sold by fish dealers in our large cities. Writing in the last Yearbook of the Department of Agriculture, Mr. E. W. Rust suggests that the opportunities for snail-growing are really much better in the United States than in Europe. While in the Old World, the snail-grower generally has but a small piece of land on which the snails must be confined by a fence of special design, and where they must be regularly fed, in this country there is an abundance of waste land where these creatures might be successfully raised without attention, and as they do not wander far, they would not need to be confined. Mr. Rust states that the Mississippi Valley offers ideal conditions for snail culture. There is no reason why snails should not be used to some extent as a substitute for oysters, which they resemble in flavor. Their feeding habits do not, as in the case of oysters, involve the possible danger of infection with typhoid and other diseases.

The Forthcoming Pan-American Scientific Congress, which is to meet in Washington, December 27th, 1915, to January 8th, 1916, has aroused great interest throughout Latin America, as well as in the United States. Several countries have appointed co-operating committees to act with the executive committee in the United States, and some have already named their official delegates. Besides these delegates designated by the several governments it is expected that the membership of the congress will include the representatives of a large number of scientific institutions to which invitations have been sent. Lastly, personal invitations have been sent to many eminent men of science in Latin America and the United States. Dr. L. S. Rowe, of the University of Pennsylvania, who has been traveling in Peru and Chile, carried a special commission to arouse interest in the congress in those countries, and several other travelers from the United States have been entrusted with a similar mission in other parts of Latin America. This congress was originally planned to meet in October. Its postponement has entailed an unfortunate conflict of dates with the meeting of the American Association for the Advancement of Science in Cleveland.

The great concrete wall at Galveston that protects the city from the ravages of the sea.

Curbing the Sea at Galveston

How the Seawall Stood Up Before the Recent Hurricane

By Brigadier-General Henry M. Robert

TWICE during the thirteen years since it was built has the great concrete wall along the waterfront of Galveston withstood the furious onslaughts of a raging sea lashed by a hurricane, and in each case the seawall has stood perfectly. In the latest storm the damage done to the city was chiefly in the business section, north of Broadway, where the plan of grade raising has never been carried out, and it was not the waves, but high water and wind that caused destruction. Wherever the plan of the Board of Engineers who designed the wall was carried out no more damage resulted than is liable to occur in any town in the interior.

The Galveston seawall was designed in the winter of 1901-02, by a Board appointed by the City Commissioners. It consisted of the late Alfred Noble, Henry C. Ripley, and the writer. Before the work was commenced the seawall and the fill and the boulevard for 100 feet behind the wall passed under the control of the County Commissioners Court and has so remained.

The seawall, which is 17,600 feet long, was afterward extended by the United States Government so as to include Fort Crockett. The total length of the Galveston seawall is now approximately 4.4 miles. It begins at the northeast corner of the city at the bay shore, where it joins the Government south jetty, crosses the island to the Gulf shore on the southeast side, and then extends in a southwesterly direction along the beach. It is a solid concrete wall 16 feet high, with a width of 5 feet at the top and 16 feet at the bottom. The bottom width of 16 feet is held for a height of 3 feet, when the sea face curves until in the upper portion it becomes vertical. The wall is founded on four rows of 40 to 44-foot round piles, with 24-foot sheet piling behind the outer row to prevent scouring. The tops of the piles are imbedded one foot in the concrete wall, the base of the wall being one foot above mean low water of the Gulf. As designed by the board, it was to be built as a monolith in 50-foot sections, with heavy reinforcing rods, connecting the top of the wall with the toe. With this construction it was believed by the board that the seawall would withstand the shock of the waves in storms like the one in 1900, even if the embankment behind it were all washed away, and the wall itself was undermined to the depth of several feet. In such case the water would be behind the wall as well as in front, and a blow on the upper part of the wall would be transmitted to the pile foundation, the front piles having to be partially pulled out before the wall could be overturned.

To prevent undermining, the board proposed heavy sheet piling under the wall and a curtain of stone 3 feet thick extending 27 feet from the toe of the wall. As this curtain was the main dependence against undermining, it may be well to notice the following specifications as given by the board.

"Rip-rap shall be placed from the sea face of the wall twenty-seven feet seaward and three feet in thickness, as shown on plans. The rip-rap shall be either granite, hard flinty limestone, or a hard sandstone, weighing, when thoroughly dry, not less than one hundred and thirty-five (135) pounds per cubic foot. No rock of a decomposed nature, or with many seams will be allowed. Not less than fifty per cent (50%), by weight, of the rock shall be in pieces weighing not less than two hundred (200) pounds, and at least twenty per cent (20%) shall be in pieces not weighing less than one thousand (1,000) pounds. Stones weighing less than eighteen (18) pounds and dirt, will be excluded. The rip-rap shall be so placed that when the work is completed the largest stones will be on the surface, with spaces between them closely filled with stones of proper sizes, so that the surface will offer as little resistance to wave action as possible."

Forms set up for a section of the wall.

The seawall was amply able, in the opinion of the board, to take care of all direct shock from the waves. But the recoil of the wave would necessarily produce scour. To remove this scour from the foot of the wall this curtain of rip-rap was designed. The intention was to cover the sand for 27 feet with small stone to a depth of 6 inches, which would be held down by a layer 30 inches thick of larger stone, laid as smooth as practicable with the object of affording the least possible resistance to the flow of the water on the recoil. The thickness of the curtain, 3 feet, was to be the same as that of the base of the wall. The outer end of this curtain would be quickly undermined in a storm, and it would adjust itself to the new conditions. As the sand is cut away the curtain would fall, all the time protecting the piling under the seawall. After the storm is over the beach would be gradually restored and probably most of the rip-rap would be covered with sand. But it would be there to serve its purpose when the next storm came. Of course it is to be expected that repairs would be necessary after great storms.

The seawall is backed by an embankment of sand, which rises above the new city grade, its crest being at a distance of 200 feet behind the seawall and at a height of 19 feet above mean low water, or 2 feet above the top of the seawall. The surface of this embankment has a 1 per cent grade toward the seawall and a 2 per cent grade toward the city. For 70 feet back of the wall the surface is paved, the first 16 feet with concrete blocks 4 to 6 inches thick, which, together with the top of the wall, form a 21-foot sidewalk. The plan provides that the remaining surface of the embankment to the crest should be covered with soil and Bermuda grass.

The writer at the request of the County Commissioners Court of the County of Galveston inspected the work immediately after the two great storms of 1909 and 1915, and in neither case did he find the seawall damaged in the slightest degree, though heavy timbers and logs were driven over it and badly damaged the boulevard. The Galveston seawall stands to-day, after being tested by two of the severest West Indian hurricanes on record, in practically as good condition as it was on the day of its completion.

This proves, beyond any doubt, the ability of a good concrete wall, founded on good piling, to withstand the shock of sea waves.

One of the accompanying photographs shows the wall standing firm even where the sea effected an entrance behind it, wrecking the brick-paved causeway and producing other damage.

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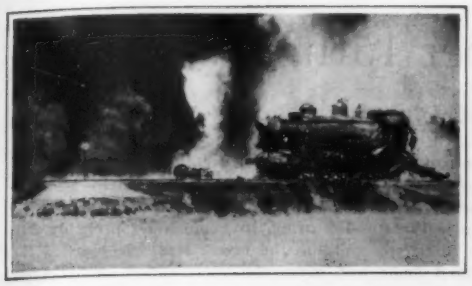
The wall stood firm even where the sea broke in behind it.



The locomotive and a truck of the oil car at the height of the conflagration.

Remarkable Collision Between an Oil Car and a Steam Locomotive

By Charles Alma Byers

THERE recently occurred on the Santa Fé system, about thirty miles southeast of Los Angeles, California, a railroad wreck that for uniqueness of cause and for spectacular climax is probably without parallel. It was produced by the collision of a runaway oil car, hurtling down grade at an estimated speed of sixty miles an hour, with a passenger train, traveling at a speed of about forty miles an hour, bound from San Bernardino to Los Angeles. It was followed by a holocaust that engulfed and destroyed the entire train, in which one trainman was killed instantly, two others fatally injured, dying shortly afterward, and about thirty passengers suffered injuries more or less serious.

The tank car, containing more than 10,000 gallons of crude oil, which was responsible for the accident, escaped from control at a small branch-line station called Olinda, situated a little more than four miles from where the collision took place, and, running down grade nearly all the way, attained terrific momentum before the crash came. The passenger train itself was rounding a slight curve, and on this account the engineer saw nothing of the impending danger until it was too late to prevent the disaster.

The impact crushed a huge hole in the forward end of the oil car, and oil was thrown like a cloudburst over the engine and the three cars behind it. The inflammable fluid instantly caught fire and the entire train became a mass of flames. It is said that not a person on the train escaped contact with the burning oil, and for a moment it seemed that all of the passengers must perish. By the automatic working of the air-brakes, however, and by the impact force of the collision, the coaches came to a standstill and became separated from the locomotive; and, while the coaches remained stationary, the engine, propelled by its own momentum and probably by reason of the fact that the throttle had not been reversed, shoved the burning oil car a short distance away from them. This somewhat lessened the volume of spraying oil and enabled the removal of the passengers through the windows of a portion of the rear coach.

The coaches, nevertheless, were thoroughly covered with the flaming oil, and being of the wooden kind they were soon reduced to ashes; only the steel of the frame and truck being left after the fire subsided. Heavy clouds of black smoke enveloped the tank car and the engine until the last of the oil was burned. The intense heat, together with the force of the collision, reduced both to a mass of twisted metal.

Olinda, the point from which the runaway tank car escaped, is the terminus of a short branch of the Santa Fé line in the oil belt of California, and its altitude is nearly one thousand feet higher than the track where the wreck occurred. Reaching the "Y" where the branch joins the main track, the heavily-loaded oil car rode over the frogs and switch without leaving the rails, and proceeded only a short distance farther when the crash came. Railroad men declare the wreck was one of the most remarkable and freaky in railroad history.

The locomotive after the fire had sufficiently subsided to permit the approach of the wrecking crew.

Huge volumes of smoke, due to the burning oil that was scattered about in the collision.

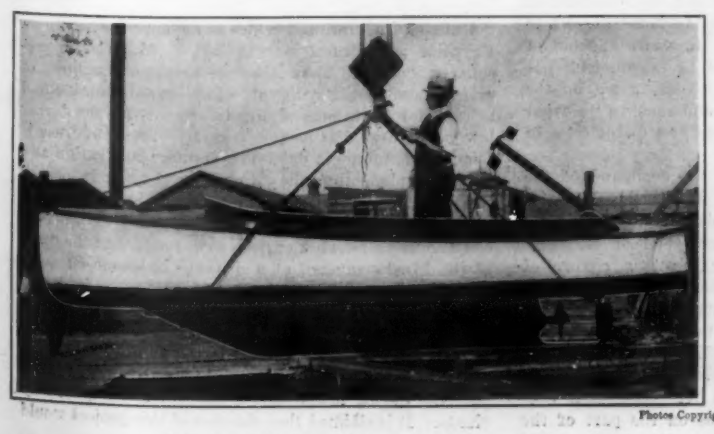
A Novel Idea in Boat Construction

THE accompanying illustrations show a boat of novel construction that has been recently brought out, and for which a number of desirable qualities are claimed. The special feature, which is really a development of an old idea, is the narrow supplementary hull joined to the bottom of the boat proper, which is of the light draught type with a comparatively flat bottom. In this lower hull is placed the engine, which is thus out of the way, leaving considerable space available in the boat for other uses. This location of the engine has other objects besides economizing room, for it places the greater portion of the weight of the propelling machinery so low that the stability of the craft is greatly increased. Besides this it is possible to place the propeller wheel in solid water, and also to keep the shaft horizontal, both of which enable the wheel to work with greater efficiency, thus gaining considerably in speed, economy and facility of evolution. By locating the wheel some distance forward of the stern, and also the rudder, it is claimed that great facility in maneuvering the craft is secured, and that the experimental boat shown will turn in a circle, but little greater in diameter than its own length. Some of the objections to the scheme are the additional cost of construction, as well as weakness introduced in the bottom of a boat; increased draught and inaccessibility of the machinery placed in the narrow supplementary hull. There is also an increased resistance to be overcome, and this form of craft could not be conveniently used as a ship's boat on account of the difficulty in stowing.

Stern view of boat with auxiliary hull.

The Current Supplement

THE topography of the regions in Europe in which the war operations are being carried on are occasionally referred to in dispatches, but the controlling influence that geography has on the campaigns and the movements of armies is but partially realized by the public generally. In the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2073, for September 25th, 1915, there is the first instalment of an article on the Geographic Aspects of War which is not only of unusual interest, but contains much information explanatory of certain movements of the armies that have not been generally understood. As a description of the topography of Europe, entirely apart from the military point of view, it will be found of great value. An unusual collection of rare varieties of toads has recently been added to the New York Zoological Park, and the notes and illustrations on the subject, from a recent Bulletin of the Society, will be welcomed by many readers. Gyrostatic action occurs frequently both in mechanics and in astronomy, but many explanations of this intricate phenomenon are difficult for the lay reader to understand. Much light is thrown on the subject in the article "How a Top Stands Up." How the depressions and eminences upon the earth's surface are formed receives some explanation in an article on isostacy that is very readable. Bird's-eye photographic views are frequently made from balloons, or from other elevated points, but these are all more or less distorted, although the detail obtained is excellent. An illustrated article in this issue describes methods for producing correct maps with the camera, with explanatory diagrams. When electric light stations were small, and the length of the circuits served short, it was a very simple matter to control and regulate the current, but with increasing size of the plants these operations rapidly became more difficult. What these problems are, and how they are met, is told in an article in the present issue. Making nitric acid of the nitrogen extracted from the air is one of the new technical processes that has been stimulated by the war, and there is an interesting article on this subject. Another technical subject of special interest is the manufacture of liquid air, which is described historically and practically, with diagrams illustrating some of the later apparatus. A summary of an article on scientific psychology discusses the subject of mental tests of dementia. There are also short articles on imitation precious stones, the coal tar industry and other worth-while subjects.



Side view of boat with narrow auxiliary hull.

Photos Copyrighted by Int. News Service.

Auxiliary hull boat turning in small circle.

Strategic Moves of the War—September 15th, 1915

By Capt. Matthew E. Hanna, Recently of the General Staff, U. S. A.

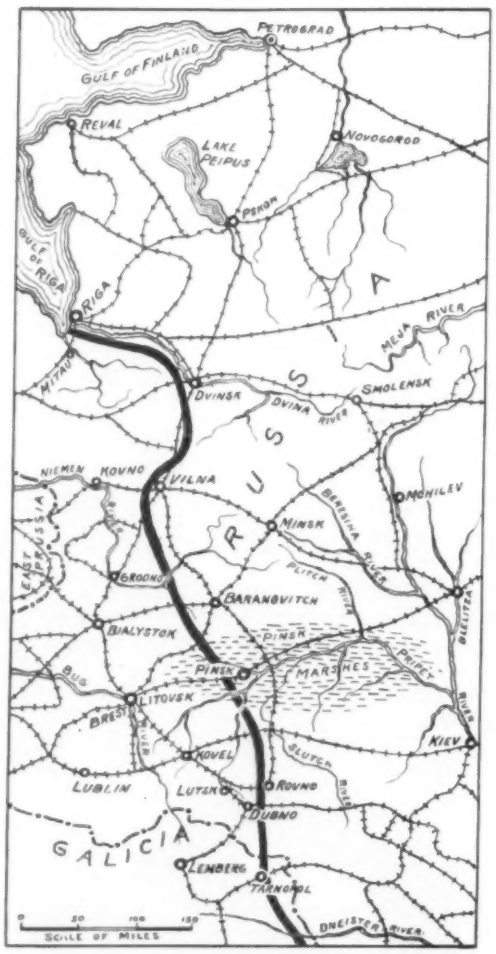
THE past week has shown fewer changes in the general situation in all of the theaters of war than have occurred in any equal period of time since the beginning of the Russian campaign more than four months ago. In the western and southern theaters practically no changes of importance have taken place with the single exception of the capture of Rovereto in the Trentino by the Italians. In the Russian theater it is very evident that the inferior railroad facilities behind the Germans and Austrians are preventing them from conducting their offensive operations with the rapidity and precision that was possible when they were nearer the better transportation facilities along the Polish frontier.

The French and English bombardment of the German lines in France and Belgium has continued, but in considerably diminished volume, and another week has passed without anything in the nature of infantry operations which would indicate that the Allies are preparing the way for a general infantry advance in this theater. We have become quite accustomed to comparative inactivity on the part of the Allies in the west. No doubt there is good reason for their not launching a general assault against the German lines at this time, which appears to be particularly favorable, but the reason is far from obvious to those who are observing from afar without the complete information that must be in the possession of the general staffs of the French and British armies.

Every passing week brings the Italian and Austrian armies on the southern frontier more nearly into a condition of stalemate. Great things were expected of the Italian offensive when it was begun some months ago and pushed to and beyond the Austrian frontier along the Isonzo River in the east, and toward Trent in the north. For a time the Italian operations were successful along the Isonzo, but they have gradually been brought to a standstill by the Austrian fortifications on this line, and further progress of importance in this region in the near future seems improbable. As already mentioned, the weeks news includes an item reporting the capture of Rovereto, about ten miles north of the Trentino frontier and about the same distance south of the important city of Trent. That the Italian forces in this region have not been able to penetrate a greater distance into Austrian territory is good indication of the difficulties with which they are meeting in this mountainous and well fortified region. The fall of Rovereto was predicted early in the Italian campaign and the Italian army has been in the vicinity of this fortress for some months. There is doubt as to whether it actually has been captured, but even if the report should be true, we must admit that the rate of progress of the invaders has been very slow. The Italians, however, are securing one important advantage in these operations, which must not be overlooked. They are establishing themselves securely beyond their own frontiers, in a position from which it will be difficult to dislodge them if at a later date the Austrians should attempt an invasion of Italy along this route. And we must not forget that the principal purpose of the Italian forces operating in this region is to protect the flank and rear of the main Italian army operating along the Isonzo.

In the Dardanelles the conditions are practically unchanged. To date the Italian declaration of war against Turkey has had no influence on this campaign so far as can be seen from reports that reach us. It was predicted that Italy would send an expedition against Turkey to land somewhere on the Gulf of Saros, but no such expedition has yet appeared in this region, and there is good reason for believing that Italy is so occupied at home as to be unable to send a considerable force to the Turkish theater of war. Reports continue to reach us of a great scarcity of ammunition in the Turkish army. If these are correct it may be compelled to abandon its position on the Gallipoli Peninsula, but its lines should be secure if its ammunition supply holds out.

The all-absorbing event of the week on the Russian front was the change in the Russian commander. For reasons far from clear to observers, Grand Duke Nicholas has been relieved from supreme command and transferred to the very inferior command of the Russian forces in the Caucasus Mountains. The Russians have "swapped horses" in the middle of the stream. Action so fraught with danger certainly would not have been taken without there being very powerful reasons behind it, but the world is completely in the dark as to what these were. Military critics everywhere have given the Grand Duke great credit for the successful manner in which he has extricated the Russian army from one desperate situation after another. Some have gone so far as to designate him as a genius in command during retreat. His conduct of offensive operations at an earlier period in the war also marked him as a skillful commander. In his conduct of the present campaign he has sacrificed a vast territory and has lost many hundreds of thousands of men in killed, wounded and prisoners, but the reports from Petrograd have told us that these sacrifices have saved the Russian army from disaster and were necessary because of lack of ammunition and other war materials. Reports from Petrograd have indicated perfect satisfaction with the strategy of the Grand Duke, but this sudden relief in the face of these reports casts doubts on their reliability and raises the question as to how far a shortage of ammunition and guns is really responsible for the Russian reverses.



The battle line in Russia.

The Czar in person has relieved the Grand Duke of his command. In doing so he is observing a tradition among the Russian people and is following in the footsteps of his predecessors. Alexander II, uncle of the present Czar, led his army to victory in the war against Turkey in 1876 and 1877, and Nicholas I, grandfather of the present Czar, commanded the Russian arms on more than one Napoleonic battlefield. More than a hundred years ago Alexander I planned and conducted the retreat of the Russian army which led Napoleon on and on into the vastness of Russia to Moscow—and to disaster. The peasant classes of Russia in and out of the army are bound to be enthused by the thought that their Emperor, the "Little Father," has given up the safety and comforts of Petrograd and come to the front to share with his army the dangers and discomforts of the battlefield.

It is not at all probable that the command of the Czar will be more than nominal, but the hand that is to guide the destinies of the Russian armies during the further progress of the war has not yet been disclosed. A change of command generally means a change of policy, and the more vigorous offensive of the Russians on the southern end of their battle front may be an indication of the policy of the new commander. He must know, however, that the policy he would like to pursue may not be the one it is possible to follow. The steady advance of the Germans for more than four months indicates such a weakness on the part of the Russian army that it may not be possible for it at this time to shift from the defensive to the offensive with any substantial prospect of success. Unless we have been greatly deceived as to the real conditions existing in the Russian army, its commander probably will be forced to continue the broad strategic plan of the Grand Duke and make the preservation of his army his principal mission, with the sacrifice of additional Russian territory a matter of secondary importance.

The Germans about the Gulf of Riga have continued their vigorous offensive against the line of the Dvina River and have succeeded in battering down the defenses at more than one point on this line, but have not yet been able to cross the river, isolate the city of Riga, and open the way to a further envelopment of the Russian right wing. A little farther south they have continued their campaign from Kovno against Vilna and the main line of railway from that point to Petrograd, and have succeeded in cutting this railway. Kovno fell some weeks ago, and it was thought at that time that the capture of Vilna would follow within a few days. The stubborn resistance the Russians have offered to a further German advance in this section is good indication of the splendid fighting spirit that still exists in their army. Still farther south a determined German advance is being made against the fortress of Rovno. With Vilna, Baranovitch and Rovno in their possession, the Germans will control a railway line which will be of vast value to them and the supply problem for the Russians will be made much more difficult.

The fighting at the present time along the entire front is largely dependent on railway considerations. The battle line from Vilna south to the Austrian frontier lies between two north and south railways. One of these, passing through Grodno, Brest-Litovsk and Kovel, is behind the German line, and the other, passing through Vilna and Baranovitch to Rovno, is behind the Russian line. They serve to distribute supplies and reinforcements along a front of about three hundred miles, and it is but a short haul for supplies or a short march for reinforcements from one or the other of these two lines to the battle front it serves. If the Germans succeed in pushing the Russians east of the line from Vilna through Baranovitch to Rovno they will have a second supply line immediately behind their battle front, and the Russians will be forced to distribute supplies by wheel transportation from the east and west railway lines which pass through Kiev, Blelitza, and Smolensk. This would be no small task, and the difficulty of keeping up supplies under these conditions would be so great that further retreat of the Russian army would be necessary.

Farther to the south the Russians on their extreme left wing and in the vicinity of Tarnopol have shown an offensive strength which must have surprised the Teutons greatly. Throughout the week they have advanced steadily and have gained one important success after another, accompanied by the capture of large numbers of prisoners. If they are strong enough in this region to continue their successes to a decisive end, they may succeed in turning the tables against the invader so completely as to upset his plans in the north. On the other hand, if this wing of the Russian army should continue to advance without securing a decisive victory, only to be definitely checked after it has penetrated some distance into Galicia, the situation of the portion of the Russian army south of the Pinsk marshes will be more critical in the end than at the present time, for it will be far out of line with the balance of the Russian army to the north, from which it might easily be completely separated by an advance of the Austro-Germans in the vicinity of Rovno.

Utilizing Underground Water in Egypt.—Writing in an Egyptian agricultural journal, Mr. V. M. Mosseri presents evidence to show that an enormous amount of underground water in Egypt, which is both potable and suitable for irrigation, is drained away into the sea during low water, and thus lost to a country that could use it to good advantage in extending summer cultivation and also in supplementing the supply from the Nile in seasons when the latter is deficient. Mr. Mosseri urges that the subterranean water supply be developed, and proposes constructing a network of deep wells parallel to the coast of the Mediterranean, at a distance of about 50 miles from the latter. He estimates that the water drawn from these wells, and that is now lost to the sea, would amount to 1,500,000,000 cubic meters during the period from March to August, and that the withdrawal of this water would hardly affect the subterranean flow toward the Nile during low water or the amount required by plants. It is claimed that the cost of this project would not be excessive.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Seamless Stocking Machine

To the Editor of the SCIENTIFIC AMERICAN:

I was very much interested reading your seventieth anniversary number, more especially as I have lived through sixty-four years of this truly wonderful period. We have seen so many great inventions that we hardly realize the great changes they have made; one following the other in such rapid succession, we are apt to lose track of the beginning, or foundation, upon which they were first started. Now, there is one thing that I would like to speak about, for I think that some little credit should be paid to the man who first invented, or evolved in his own mind, the machine or appliance that held the key to a solution of any great invention, even though he was not able, through lack of means or education, to reap any profits from the manufacture of or application of his invention. Speaking of "mechanical marvels," you say "most wonderful of all was the rotary knitting machine built by Lamb of Valparaiso, Ind., in 1866," that after being improved, manufactured a seamless stocking. It surely was a great boon to everyone wearing stockings, for it not only gave them comfort, but greatly reduced the cost to them. I would like to call your attention to a few things about this. In 1865, Samuel Wallis, my father, *invented the method* that contained all the principles that, when applied to the old flat hand frame, circular frame, or any other kind of a stocking machine, would give us either a seamless toe and heel, off of the flat frame, or a seamless stocking on a circular or rotary machine. In 1865 your people got the patent on this method for him. In July of 1865, father moved from Lowell to Lake Village, N. H. He had been working at the Lawrence corporation. John Pepper was superintendent at that time, I think, if I remember rightly; that father made Mr. Pepper assignee, and Mr. Pepper was to furnish the capital to push this invention.

Mr. Pepper was very busy building a machine, and after working all fall and winter for the Appletons, father lost hope of John Pepper ever doing anything, and in the spring of 1866 moved to Braintree, having no means himself, and not the faculty of soliciting help, he let the matter drop. He made what stockings he could buy yarn for, on his own machine and peddled them, or I did it for him.

Father always maintained that a "supposed" mutual friend divulged his secrets of applying his invention to the circular frame to one Mr. Shaw, who produced the well-known "Shawknit." Whether this was so or not, it does not matter. The self-same principles contained in father's invention were applied to the circular latch needle machine that father used on his own flat hand frame.

If you could look over the testimony that was taken in Boston in 1881, 1882 or 1883, in the infringement case, "Shaw v. Allings and others," you would see that what I say is about right. I certainly feel that I ought to say this much in justice to Samuel Wallis, my father, the man who *first made a seamless* heel and toe to a machine-made stocking. He was an inventor, and besides the three inventions that were patented, his inventions of design and improvements would mount into the hundreds.

W. T. WALLIS.

Rowley, Mass.

We Need Battle Cruisers and Submarines

To the Editor of the SCIENTIFIC AMERICAN:

It seems to me that if the war has demonstrated anything, it is the value of submarines and battle-cruisers. The United States is as helpless as a new-born babe in these two branches of the service, as what few submarines we have are practically worthless, and we have no battle-cruisers at all. I believe it has been the policy of the Navy General Board to continue to build battleships as a first line of defense, but from what I have been able to learn from reading the SCIENTIFIC AMERICAN for several years, I do not believe man has yet been able to build anything in the way of forts or ships, no matter how heavily armored, that can withstand the continual hammering of powerful, big caliber, long range guns. Therefore, it seems to me we should start on some definite and fixed policy of building battle-cruisers of high speed, light armor, and to have the largest (14- or 15-inch) and longest range guns. The increased displacement heretofore necessitated by the heavy armor on the low-speed battleships could be utilized in the battle-cruiser by additional boilers and engines to drive the latter at high speed, say 28 to 32 knots. I would suggest that the next Congress authorize sixteen of these battle-cruisers, all to be built and in commission within three years, eight of them to have a speed of not less than 28 knots and eight of not less than 30 knots per hour. It might overtax our shipbuilding plants to build that number, considering other construction already in hand, within the time stipulated, but if we made up our minds to do it, I am sure it could be easily accomplished. The next Congress should also authorize the construction of not less than one hundred submarines.

San Antonio, Tex. HERBERT SPENCER.

Trisecting an Angle Mechanically

To the Editor of the SCIENTIFIC AMERICAN:

An angle may be trisected, mathematically, and with as much accuracy as it may be bisected. The proof of this fact is an old one, but one that is surprisingly little known.

The proposition is very simple, depending on a curve called the "conchoid." In this curve, the distance, measured along a line through a fixed point, of any point on the curve, from a fixed line, is always the same. Thus, in Fig. 1, the distances *CD*, *C'D'*, etc., are all equal to each other.

The practical value of the proposition rests on whether this curve can be accurately constructed or not. Fig. 2 shows the top view of a simple instrument for drawing it. It consists of two pieces of steel, the lower one slotted and provided with a round pin, over which the upper arm passes, as shown. The lower piece is notched to permit accurate placing over certain lines. The upper piece has a pin on its under side which fits in the slot in the lower piece and provided with a movable pencil-point, *P*, which can be set at any place on the arm. Fig. 3 shows a vertical cross-section of the instrument. Holding the under piece still, and swinging the upper, with the pins in their slots, causes the pencil-point to describe the "conchoid," and by sliding

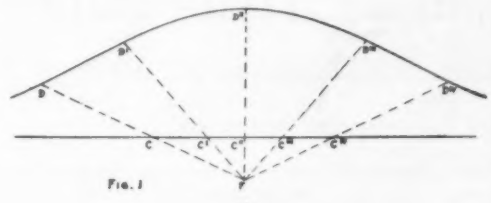


FIG. 1

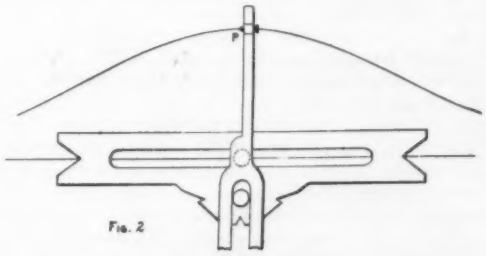


FIG. 2

FIG. 3

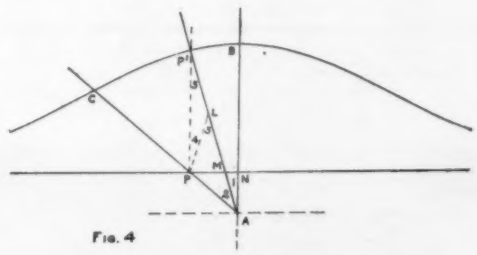


FIG. 4

Mechanical method of trisecting an angle.

the point and setting it, a curve of any radius may be drawn. This instrument can be made as accurate as a pair of compasses, which are considered sufficiently accurate for the bisection of an angle.

Let us take any angle, such as *CAB*, in Fig. 4. *AB* is extended and a perpendicular to it erected at *A*. The instrument is then, by means of the notches, placed so that the center of the pin on the lower piece comes directly over *A*. We then construct the line *PN*, the line bisecting the slot, and of which we have two points, given by the notches at the ends of the instrument. Having constructed *PN*, we lay off *NB*, equal to twice *AP*, place the instrument in its proper place, set the pencil-point at *B*, and construct the curve. At *P*, we erect a perpendicular to *PN*, and connect the point where it cuts the curve, namely, *P'*, with the vertex of the angle. Angle *P'AB* is one third the original angle.

Proof:

Connect *L*, the middle point of *P'M*, with *P*. Then, by plane geometry, since *P'PM* is a right triangle, *P'L*, *PL*, and *ML* are all equal. But *ML* is equal to *PA*, since it is one half of *PM*, which was made equal to twice *PA*. Therefore, we have two isosceles triangles, *P'LP* and *LPA*. Angle 3 is equal to angle 4, plus angle 5, and since angle 4 equals angle 5, angle 3 equals twice angle 5. Angle 2 equals angle 3, therefore angle 2 equals twice angle 5. Angle 5 equals angle 1, since they are alternate-interior angles of parallel lines, therefore angle 2 is twice angle 1, and we have angle 1 equal to one third of angle *CAB*. Q. E. D.

Safety of Lake and Coastwise Passenger Steamers

To the Editor of the SCIENTIFIC AMERICAN:

On seeing the pictures of the steamer "Eastland," anyone who was at all acquainted with boats can see why she upset. The hull is so fine at both ends, evidently being built for speed, that there is not underwater body enough to carry the three upper decks which extend over her whole length, and the side plating of steel is carried up one deck above the hull strictly, adding enormously to the weight above the hull. The size of the ship does not warrant such towering upper works. It seems to me that it should be evident to anyone that the design, in the first place, is worse than faulty. She never should have been given a certificate to carry passengers at all in rough water.

The question arises with all of us who travel sometimes by water, how many of our own coastwise steamers are top-heavy? I know none of them which have such an utterly disproportionate hull under them, but there are large numbers of them built up four and five stories above the hull, raising the center of gravity enormously. I often have looked at them and questioned in my mind whether or not they had sufficient metacentric height to be stable, especially in rough water, which most of them have to encounter or are liable to encounter on every trip. Is it safe for such ships to depend upon water ballast for stability? Ought they not to be so designed as to upper-works that the weight of their own hulls, engines, boilers, etc., would be sufficient to give them stability? Water ballast is all right to be used simply for trimming the ship, but it ought not to be depended upon as vitally necessary to keep her from turning over. Owners are so anxious to carry freight in the hull and on the main deck and then build several stories of passenger accommodation above this, that they overload the hull beyond all safety. The ships are like a skyscraper set on one or two piles in the middle of its base instead of piles all around the edges.

I am sure that there are thousands of persons using our coastwise steamers every year who would like to hear from some competent authority on this subject through your columns, and to be somewhat reassured as to the stability of such lofty skyscraping steamers as run between here and Maine points as well as between here and New York. Have inclining experiments ever been made on any of these boats and their exact metacentric height calculated? Ought this not to be required before a certificate is given to carry passengers? I, for one, would like to hear from the Inspection Department on this subject. C. D. IRWIN.

Brookline, Mass.

Cipher Codes Simplified

To the Editor of the SCIENTIFIC AMERICAN:

The use of numeral values assigned to the letters may, in some cases, simplify a cipher code for translation or detection.

Take C. E. Edwards's key-word and message:

BLA CKBLACK BLA CKBLACKBL AC
THE GERMANS ARE ADVANCING ON
KBLAC
PARIS

Assign to the letters, B L A C K, the numerals B-3, L-13, A-2, C-4, K-12, which may be found by adding one in each case in the following table:

A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	2	3	4	5	6	7	8	9	10	11	12	13	14
O	P	Q	R	S	T	U	V	W	X	Y	Z		
15	16	17	18	19	20	21	22	23	24	25	26		

Write the key-word and message in these numeral values, and subtract. Where the minuend is not greater than the subtrahend, borrow 26—borrow for keeps, if you please.

Written in numerals for subtraction, it appears as follows:

3	13	2	4	12	3	13	2	4	12	3	13	2	4	12	3	13	2	4	12	3	13			
20	9	5	7	5	18	13	1	14	19	1	18	5	1	4	22	1	14	3	9	14	7			
9	4	23	23	7	11	26	1	16	19	2	21	23	3	8	7	12	14	1	3	15	5			

The numbers 9, 4, 23, etc, to be translated by the above table, which gives IEWWGK, etc., the same as found by Edwards's code. It is translated back again by subtraction, as before. Even in this case the key-word must first be found before any translating can be done.

Suppose the word "Black" were given thus, "Black-1," meaning that one was to be added as above; it is evident that "Black-2" or "Black-3" might have been taken. For instance, "Black-2" gives B-4, L-14, A-3, C-5, K-13, all of which mystifies the mystery. IRA J. PADDOCK.

Nebraska City, Neb.

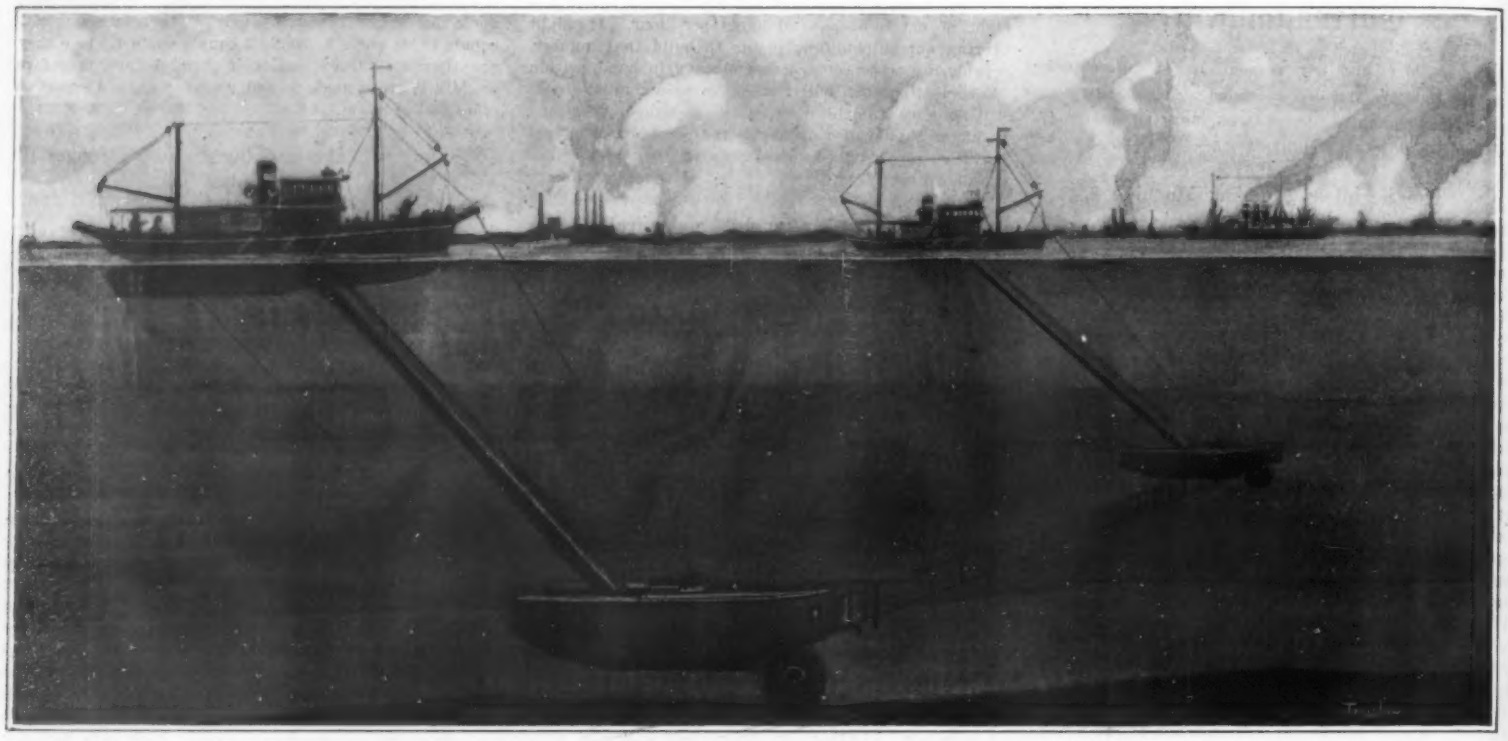


Fig. 1.—How the device is used when making underwater surveys. The sweep line extending between the two submarines gives notice of any intervening obstructions.

Submarine for Hydrographic Work

Method of Discovering Dangerous Pinnacles in Rocky Bottoms

By Simon Lake

MY work with submarine boats, both in the United States and foreign countries, has taught me that most charts are very unreliable as far as their recorded depths are concerned. While they may be fairly accurate as to the average depths, they do not record many of the peaks or depressions that exist, especially where the water bed is formed over a rock foundation. Silt and sand may fill in the depressions between peaks so that the average depth is fairly constant, yet here and there are outcropping peaks or humps that have, in many instances, proven fatal to shipping.

The method of charting our coast lines and the estuaries of the sea has been by the use of the sounding lead, taken at points a greater or less distance apart. The depths recorded at these points are plotted by the triangulation method of location from tripods or known structures, or objects on shore, and shown on the chart. These points would need to be taken every few feet to give an accurate topography of the bottom, the cost of which, in both time and money, would be prohibitive. Assuming that our coast waters were sounded, and depths recorded, at points only 50 feet apart in all directions, even such close soundings would not guarantee that some peak might not project above the bottom and prove disastrous to some ship.

I remember some few years ago the battleship "Missouri" struck such a peak in New York harbor, seriously injuring her bottom. Thousands of ships of equal draft had passed this vicinity, but none of them had happened to strike this particular spot and no one suspected that such a rock existed in this much frequented highway.

In 1900 the steamer "Rio de Janeiro" struck an unknown rock in entering the harbor of San Francisco, with a loss of 131 lives and over two million dollars in property.

In Long Island Sound, we found, during a deep submergence trial with one of our submarines, a depth of 256 feet, whereas the chart indicated a depth of only 27 fathoms (162 feet).

In one instance in Russia we were conducting submerged trials on the official trial course of the Russian government in the Gulf of Finland (this was the course on which they tried their surface torpedo boats), and we were assured that there was not less than 60 feet of water on the course, yet we struck rock peaks twice on this course in less than 30 feet depth. The record of ships that have been lost due to striking uncharted rocks and shoals is a large one, and a more correct topography of the waterbeds of our coast and inland waterways should be had. In 1899 and 1901 considerable time was spent in experimental work with the submarine boat "Argonaut" in locating sunken ships and recovering their cargoes. To find a sunken ship, it was necessary to search the bottom thoroughly, and many experiments were made, and success attained to such an extent that we could search thoroughly an underwater area of from 10 to 20 square miles per day. It is the result of this experimental work that has led to the design of the herein described apparatus, which will give very accurate contour records of the bottom within such depths as would prove of interest to navigators of either surface vessels or submarines. The advent of the submarine has made it more important to know where obstructions exist, as they require at least 70 feet depth to navigate at speed entirely submerged, and to enable them to keep below the bottom of surface ships. This method of waterbed surveying consists of using two or more submarine boats of my bottom navigating type, with access tubes extending to surface vessels. Instead of using two bottom wheels arranged in tandem, as is used on my military submarine, I use a single pair of toothed driving wheels, capable of being swiveled and driven to propel the submarine in any desired direction over the bottom.

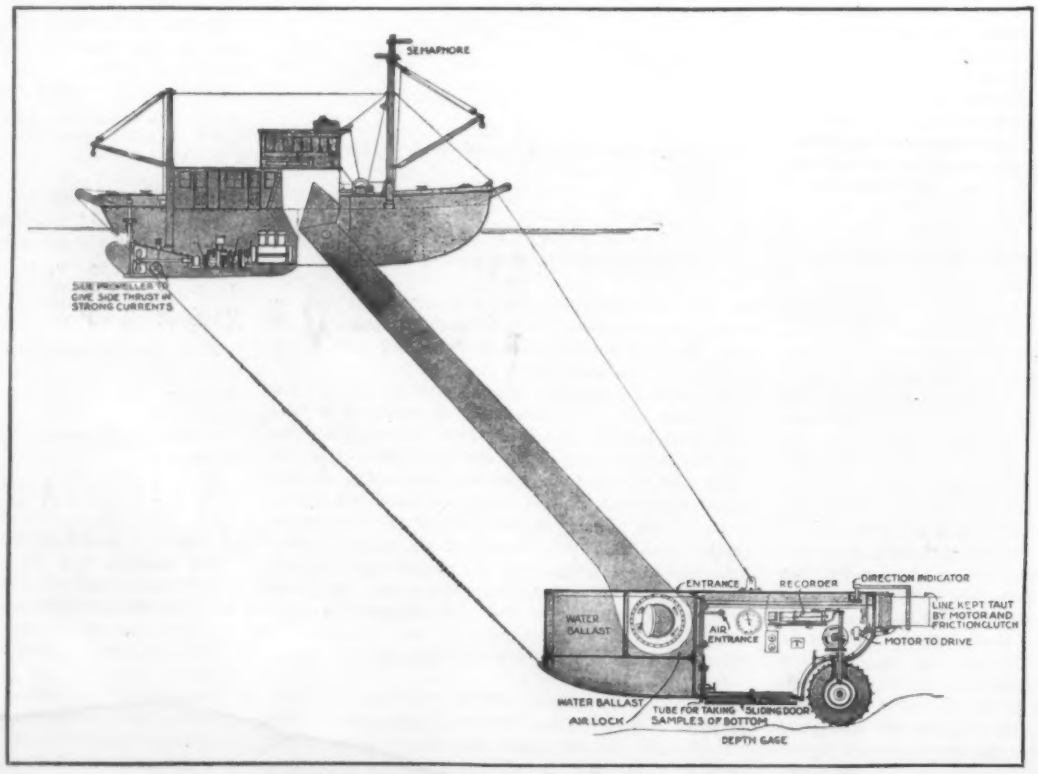


Fig. 2.—Sketch of the submarine surveying and exploring apparatus, showing details and location of the various parts.

The submarine vessel also contains a diver's compartment, so that examinations of the bottom may be made and a record kept of the materials and conditions found, which are recorded as frequently as may be desired directly on the contour sheet, on which the soundings are being automatically recorded.

Navigators of surface vessels are interested principally in

knowing the amount of water they have beneath their keel, and the nature of the bottom, so that they may judge of their location by soundings, especially in time of fog. It is not essential, therefore, to know every foot of the bottom, but it is essential to know that no obstructions exist extending nearer to the surface than their keel. It is also essential for submarine commanders to know that there are no obstructions nearer the surface than their depth of submergence, if they are running submerged at speed.

It is possible that collisions with submerged obstructions may have been responsible for some of the mysterious submarine fatalities.

This method of bottom investigation permits of very accurate contour lines being run as close together as may be desired for harbor work. On the coast, in depths exceeding 50 to 75 feet, if contours were run one half mile apart, it would probably be satisfactory if a guaranty could be given that there were no obstructions over 5 or 6 feet in height, which lay between such contours.

Two vessels such as herein described are capable of automatically recording parallel contours at the rate of two or three miles per hour and to guarantee that there are no dangerous obstructions lying between them.

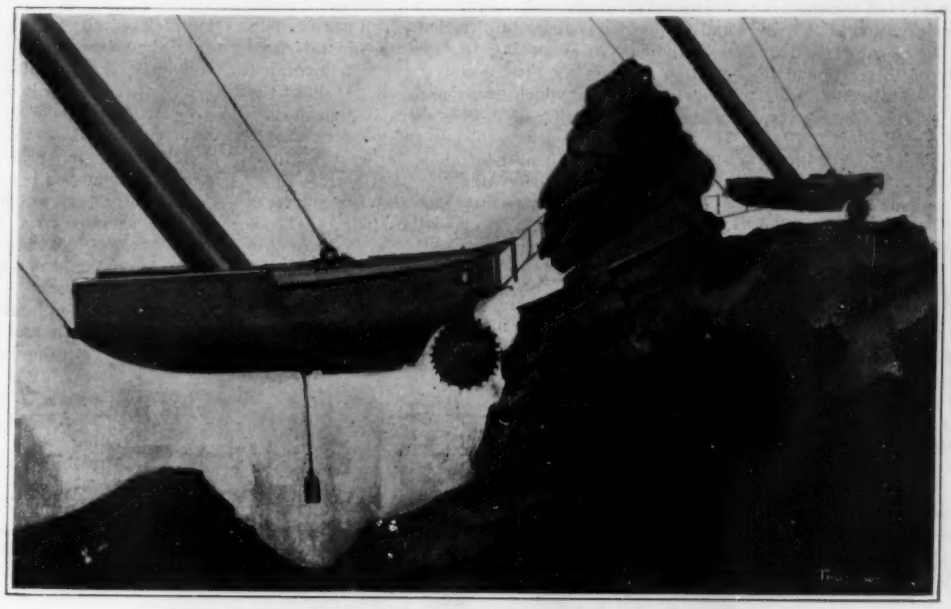


Fig. 3.—The submarine explorer investigating a dangerous rock pinnacle.

Referring to Fig. 2, a surface vessel is shown with a well which extends from under the pilot house, and out under her stem. An access tube extends from this well, forward to a small submarine vessel. The upper end of this access tube is pivoted to strong bearings secured in the sides of the well, and is further secured by tension rods extending from partway down the tube to bearings secured to the outer skin of the ship in line with the bearings in the well.

Large bearings with stuffing boxes in the submarine boat end of the access tube permit of access through a door to an air-lock compartment; and a second door leads from the air-lock into the diving compartment, a sliding door in the bottom of the diving compartment permitting the door to be opened for inspection of the bottom. By donning a diving suit members of the crew may also leave or enter the vessel when on the bottom. The water is kept from entering the diving compartment by air compressed to the same pressure as the surrounding water pressure, corresponding to the depth of submergence, the same as is done in my military submarine boats.

A motor, drawing its power from a dynamo on the surface vessel, drives through suitable gearing the tractor wheel arranged near the bow of the submarine. This tractor wheel may be turned by its vertical steering post so as to propel the vessel in any desired direction.

The weight of the submarine upon the bottom is regulated by water ballast. A depth recording device operates in connection with a distance recording apparatus, so that an exact contour of the bottom is reproduced on a roll of paper; the record being made by the revolution of the tractor wheels. Correction of errors are made by taking observations from the surface vessels from known points on shore, by the usual triangulation method.

A drum is mounted on the submarine on which is wound a double wire. The upper wire is an insulated wire and is used to telephone between the two submarine vessels, when used as shown in Fig. 1. The lower wire is a bare wire and is used to locate obstructions. The two wires are secured together as shown. Suitable recording devices in the interior of each vessel give the amount of wire unwound from its drum. A tension regulator holds a certain desired strain or pull upon the sweep lines, and another indicator gives the direction of lead of the wires during the "sweeping" operations. The surface vessel has a propeller in her skeg operating athwartship in addition to the usual stern propeller.

The method of operation is as follows: Two vessels are required, which proceed to the location to be charted. In surface navigation the submarine, carried at the forward end of the access tube, is emptied of her water ballast, and floats on the surface in front of the surface vessel, being "pushed" ahead of the latter vessel by the access tube, the pivoted bearings at each end of the tube giving sufficient flexibility to prevent any damage to the tube because of strains set up by the waves.

One of the vessels takes her station at the point of beginning the day's survey and anchors, the other vessel then comes sufficiently near to secure the end of the sweep line from the anchored ship and then moves over to her starting point, which might be only a few yards away or as much as a mile (I have found in wreck sweeping operations that it is practical to go as much as a mile apart), depending upon how close together the contours are desired. These sweep lines of the two vessels are then joined together and the submarines sink to the bottom, on which they are allowed to rest with sufficient weight to prevent their being drifted out of their course.

We will assume that their starting points are one half mile apart, and that they are to run contour lines due west from their respective starting points; the boats should, therefore, lie due north and south from each other, and the sweep lines should lead at right angles from each toward its companion boat. The dynamo is now started in the surface vessel to supply the motors in the submarines with power. The two submarines now start ahead.

The surface vessels by means of their athwartship propellers are always kept headed due west, therefore the course must also be due west. Each operator in the submarine keeps watch on his indicator, which records the amount of line paid out, and also enables him to be kept advised by frequent inquiry through the telephone of the amount of line his companion vessels has out. The operators also keep each other advised of the distance their respective vessels have traveled and the direction of lead of sweep line. Thus they can always keep each other on lines due north and south. If now an obstruction is struck, such as a rock, a sunken ship, etc., the strain on the sweep line becomes greater than normal, and the line commences to run off its drum. After running a short distance the sweep line will begin to lead aft instead of at right angles to the course. The two operators then stop and advise each other of the lead of the line. The one whose line leads the greater number of degrees off from right angles to the course, is nearest the obstruction. He now turns his tractor wheel in the direction of the lead and "wheels" over to the obstruction taking in his sweep lines as fast as he goes. The characteristics of the obstruction are noted, and its position accurately located by the trianguiation method and recorded on the chart.

In practice this sweep line extends a few feet above the bottom so as not to pick up small boulders, stones, etc., and would only be caught on the larger submerged objects. In taking off the readings from the contour sheets, when plotting the depths on the charts, the assurance can be had that no obstructions exist between the surface and the depth of the sweep line, as the depth and contour recording gage is located at the height of the sweep line. The actual contour depth would be the distance between the sweep line and the waterbed, which could be added if desired. Fig. 1 illustrates the above described method of operation.

The cover shows a bow view of the submarine, the sweep line and tractor wheels. The cables shown would be necessary for the ship's propeller to assist, as the traction wheel would not "pull" going up a precipice.

Fig. 4 gives a bow view of the submarine, and shows the sweep line and tractor wheels. The cables shown leading from the bow and stern of the surface vessel to the submarine vessel serve in keeping the submarine on a level keel. Fig. 2 shows the arrangement of surface vessel, access tube and the submarines resting on the bottom. This is a type of apparatus suitable for depths up to about 100 feet. For deep-sea work the upper end of the access tube would be secured in such a manner as would permit the surface vessel to rise or fall, or to roll with the sea, independently of the access tube.

Searchlight Automobile for the Italian Army

A PORTABLE military searchlight has been developed in Italy which lays claim to several novel features. The motor car which carries the searchlight as well as the generating equipment is fitted with a 30 horse-power motor. This motor is capable of driving the machine at approximately four, seven, nine and twelve miles an hour on the first, second, third and fourth speeds, respectively; while gradients of fifteen per cent are easily negotiated on the first speed. The front wheels of the truck are fitted with single tires, while the back wheels are provided with twin tires.

One of the new searchlight automobile equipments of the Italian army.

The generator used in supplying the current to the searchlight is of the direct current, inclosed type, with an output of 100 amperes and 80 volts, and is operated by the coupling shaft through two toothed wheels and a silent chain. The generator is provided with a fan for the purpose of cooling the windings. An electro-magnetic control acting on the carbureter steadies the speed of the gasoline engine, whether the projector is working or not.

The body of the car is in many respects similar to that of the conventional touring car. It contains six

(Concluded on page 278)

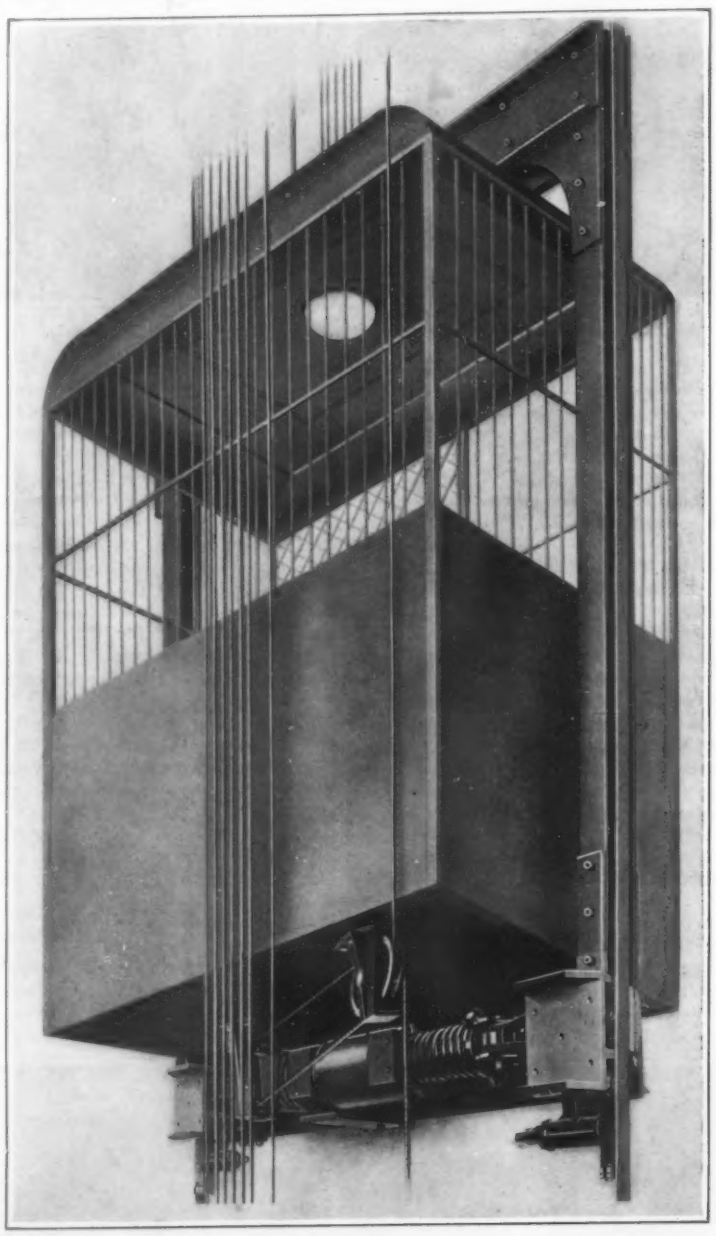
When the Elevator Runs Away

NOTWITHSTANDING the many years that elevators have been in general use, and the numerous improvements that have been made to increase the safety of their operation, there are still people who enter an elevator with feelings of decided trepidation; and perhaps this is not to be wondered at among those who do not have frequent occasion to visit our modern sky-scraper buildings and so become accustomed to such things, for in these the speed of the elevators is truly remarkable. An extreme example of this is found in the building in which the offices of the SCIENTIFIC AMERICAN are located, where the express elevators, on the long portion of their run, attain a speed of 700 feet a minute, the limit allowed by the New York Building Department, but this is exceptional.

Some comfort may, however, be found in the fact that, considering the number of elevators in constant use, accidents are of very infrequent occurrence, and of these fully 80 per cent are caused by open and unlocked gates, or negligence on operating the gates. Accidents from breaking of the hoisting ropes are very rare, as the risk of a break is divided by using a number of cables, and the combined strength of all is at least eight times what is required to sustain the heaviest load that can be put upon them. If, however, such an unusual event should occur, or if the car should get out of the control of the operator from any other cause, a number of protective devices are at hand that insure the safety of the passengers.

Practically all of the fast passenger elevators now being installed are operated by electricity, and in them provision has been made for any contingency. Of course, there is a brake on the hoisting mechanism for controlling the car in its ordinary operation in making stops, but to provide against accidents there is a powerful apparatus attached to the car itself that is capable of stopping the car in any emergency. A recent form of this apparatus is shown in the accompanying illustration. Grip shoes are arranged to grasp the guide rail fixed in the elevator shaft, and these are carried by levers that are operated by wedges that can be driven between the arms of the shoe levers. These wedges are operated by helical steel springs that ordinarily are held under compression by electro-magnets. The instant the current in this magnet is interrupted, either by the centrifugal governor, or the safety switch on the car or the limit switches in the hatchway operated by the car or counterweight, the springs are released and apply a moderate pressure on the wedges, giving a light retarding force on the grip shoes. The grip operating wedges are also connected with powerful right- and left-hand screws, upon which is mounted a drum around which is passed a safety rope, connected with the centrifugal governor and the counterweight. In case the hoisting cables break, the pull on this safety rope turns the screw, setting up the grip operating wedges very strongly, and the car is thus quickly and easily stopped.

Both of the above safety devices operate so quickly and with such certainty that it is impossible for the car to gain any considerable headway beyond the predetermined speed of operation, and consequently there is little possibility of passengers being injured by the shock of stopping, no matter what the cause of throwing the safety devices into action. Such a thing as a falling elevator car is almost unknown.



Grip shoes actuated by powerful springs when released by electro-magnets.

Solid Oils for Transport

A PATENT has been obtained in France for an improved method of handling petroleum and derivatives by obtaining a product of gelatinous consistence which can be easily carried and loses its explosive properties such as often make handling of such material dangerous. The mass can be burned by lighting it with a match, in which case it burns slowly. The new method consists in producing a soapy paste into which the oil is incorporated by stirring or otherwise mixing up in the proper manner. Such paste is made, in the first place, by taking about equal amounts of ordinary soap and water, and it enters into the composition of the final product in the proportion of 1 to 50 per cent, according to the case. The oil, etc., can afterward be brought to the original state by treating with alcohol or other solvents.

Rear Signaling Devices for Automobiles

NO one knows how another's mind will work, and this is why there is a real need for some sort of a device on motorcars which will permit the driver of a car to indicate to drivers who may be following him the direction he is about to take and when he will stop.

There have been numerous instances of rear end collisions which are directly attributable to the quick stops and the sudden changes in direction which are possible with the modern motorcar. In cognizance of this fact, the New York Safety First Society recently inaugurated a series of tests which were designed to show the method of application of devices calculated to obviate the possibility of such accidents and to demonstrate their working. A number of these devices are illustrated and described herewith.

Broadly speaking, these little motorcar monitors may be divided into two general classes, as follows: Those that are mechanically operated and those that are electrically operated. It is to be understood, of course, that even those that are mechanically operated employ electricity as the illuminant, without which they would be virtually worthless after nightfall.

The signal which is illustrated in Fig. 1 consists of a small rectangular metal box, containing three electric bulbs which are located behind the three lenses, respectively. Ordinarily only the central red lens is illuminated. Buttons permit the lamps behind either of the other lenses to be lighted at will, when a light colored arrow becomes plainly visible and points out the direction of the coming turn. This device also serves as a bracket for the license plate. A similar signal is shown in Fig. 6, which will be described later.

In Figs. 2 and 8 we illustrate a signal which depends for operation upon a wire control. The control device which is shown in Fig. 8 is nothing more than a small lever. This operates the wire, which in turn rotates a rectangular member encased in a cylinder at the rear (Fig. 2). The four faces of the rectangular member indicate RIGHT, LEFT and STOP and blank, respectively. At night the signal is illuminated by a small electric light bulb. There are openings at the top of the casing so that the license plate is illuminated at night.

In Figs. 3 and 5 we illustrate what is probably the most ingenious of all the devices tested by the Safety First Society. At the same time it is one of the simplest from the installation point of view, for there is no connection between the signal itself, which is located at the back of the car, and the controlling apparatus, other than two slender wires. The device is purely electrical and is operated from the storage battery that forms part of the equipment of every electrically lighted and started automobile. It may be operated by three ordinary dry cells, however, when no storage battery is available. From which it becomes apparent that the current consumption is low.

The controlling mechanism consists of a small lever (Fig. 5) mounted on a casing which is fastened to the steering wheel. Within the casing there is an automatic stop mechanism which operates in much the same manner as that used by the Western Union and Postal telegraph call boxes. The letters S, R, and L on the casing indicate the signal which will appear at the rear. When the lever is moved to S, for instance, the word stop appears at the rear. The box at the rear is a light casing which has inside of it a square, or rather rectangular, member with four faces marked STOP, LEFT and RIGHT; the fourth face is plain white and shows when the control lever is in the neutral position. When the control lever is turned, the rectangular member is turned by an electro-magnetic device until the face corresponding to the mark on the controller shows. Thus, if the lever is turned one complete revolution, the rectangular member will also turn one complete revolution. At the same time a tiny bell rings to call attention to the signal which is automatically illuminated in its final position.

In Fig. 4 we have a simple mechanical signal type. In this device there is a large red arrow which is hollow and perforated, supported in a vertical plane. As in the case of Fig. 2, this signal is operated by a wire connected with a small quadrant on the steering column. It permits the arrow to be moved into a horizontal position either to the right or left. At night the arrow is illuminated by electric lamps contained within it. These lamps are lighted as soon as the arrow commences to move and a loud-sounding electric bell rings while the arrow is down. The stop signal normally is covered by a shutter which is raised by moving a lever, thus revealing the signal.

The device shown in Fig. 6, which was referred to above in connection with Fig. 1, consists of a small metallic box containing three electric lamps behind three transparencies, respectively, which consist of an arrow for left and one for right and the word STOP. The control mechanism, which is not shown because of its extreme simplicity, consists merely of three switches. The switch which connects either of the lamps behind the arrows is a double one, operating in a horizontal plane and closed one way for one arrow and the other way for the other arrow. The third switch, for the STOP sign, operates in a vertical plane; all three are mounted on the steering column or at any other convenient place. Although the arrows appear in the picture, they are not visible in the day and only at night when the lamps behind them are lighted. A smaller signal, without the word STOP, is used at the front of the car.

The device illustrated in Fig. 7 differs from all the others in that it is operated automatically at the instant that the brakes are set. The casing contains two electric bulbs, one behind a red and the other behind a green lens. The red light is always visible. Through interconnection with the brake pedal, and also with the emergency brake lever, the tiny shutter in front of the green lens drops at the instant that either brake is applied.

Some Adjudicated Patents.—The Groehli patents, Nos. 593,206, 593,208, 607,848, 609,429, 618,458 and 637,458, relating to embroidering machines operated by Jacquard mechanism, were held valid as limited by the prior art but not infringed in Laeb v. Schoenfeld Company v. Atlas Embroidery Works; the Bone patent, No. 705,732, for reinforced concrete retaining wall, was held valid and infringed in city of Akron v. Bone.

Fig. 1.—A three-bulb electric signal.

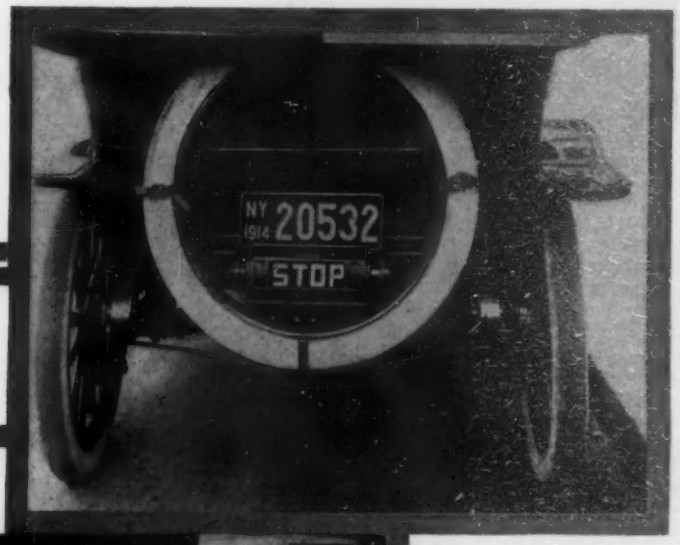


Fig. 2.—Wire controlled box signal.

Fig. 3.—Electric box signal.

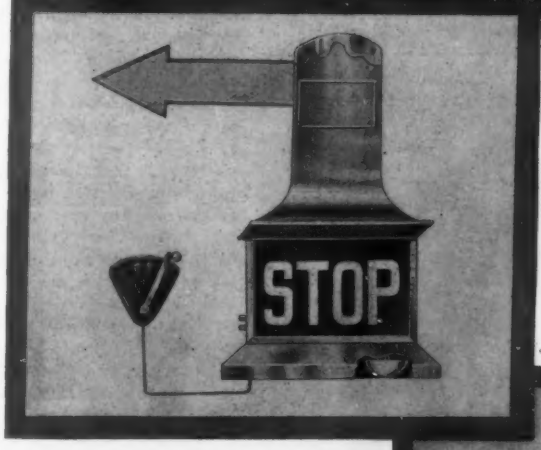


Fig. 4.—Swinging luminous arrow.

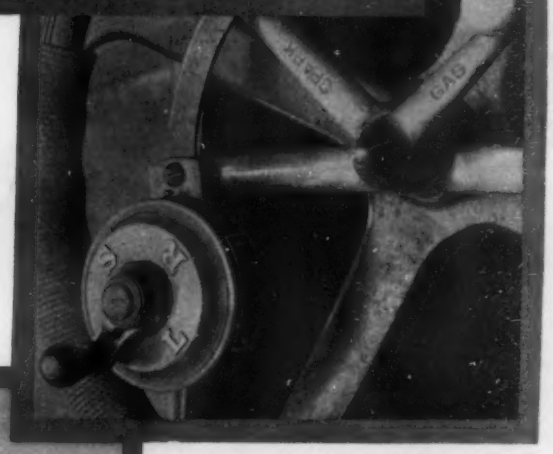


Fig. 5.—Control lever of Fig. 3.

Fig. 6.—Electrically illuminated transparencies.

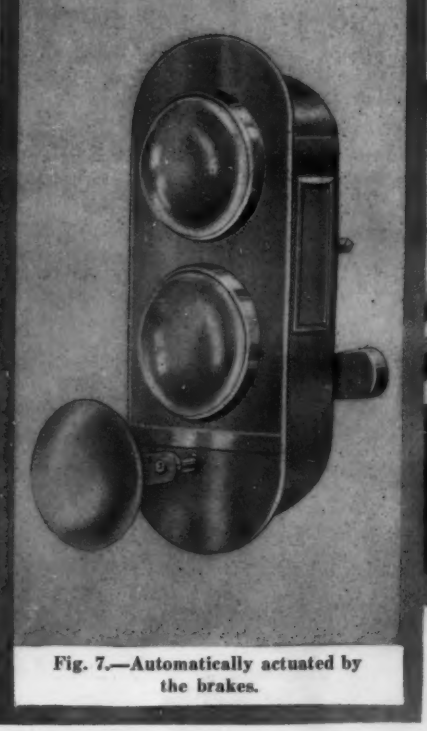


Fig. 7.—Automatically actuated by the brakes.

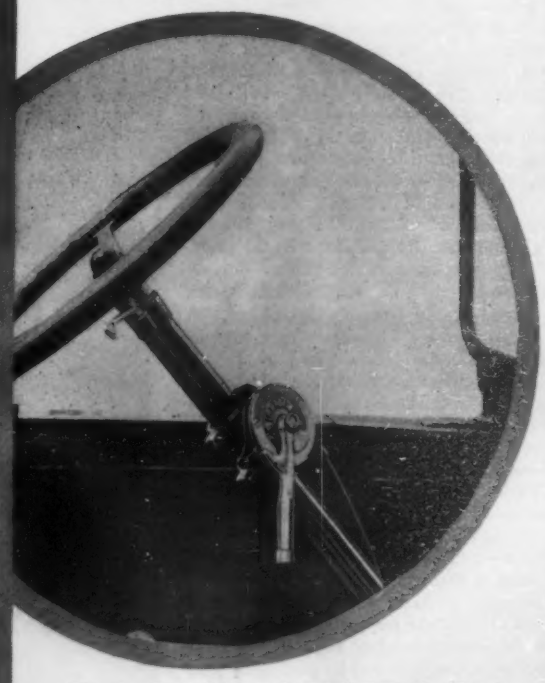


Fig. 8.—Control lever of signal shown in Fig. 2.

REAR SIGNAL DEVICES FOR AUTOMOBILES

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

A Combination Traveling-bag and Life-preserver

A VALISE that may be used in emergencies as a life preserver promises to be a necessary part of the equipment of the careful traveler in the near future. It is the invention of John L. Edmund, a young Norwegian.

The new combination traveling-bag life-preserver is to all outward appearances an ordinary hand bag. However, it is equipped with a pair of waterproof trousers which, together with the valise proper, forms a buoyant, watertight suit. There are also provided two fin-like bags in which the wearer can place his arms, and, if he so desires, propel himself through the water. The body of the case is equipped with a window and two air valves which may be locked from the inside. It is optional with the wearer whether the bag portion is closed or not, since the suit will not sink. The position of the wearer when in the water is one of perfect comfort; he may stand upright, lean on one arm or rest on the back or side without danger of tipping. Sufficient food to last for several days can be taken into a compartment intended for the purpose in the suitcase portion. Should an accident befall the outer covering, there is an emergency air bag which may be blown up from the inside and which will provide the necessary buoyancy to keep the suit and its occupant floating. The wearer of the suit may remain in the water for from four to five days without danger of sinking or death by exposure, and in these days of the perfected wireless telegraph it is seldom more than a few hours before rescuers are on the scene after the sinking of a vessel.

Normally, the trousers portion and the fins of the life-preserver are folded compactly into the bottom of the suitcase, leaving ample room for anything one may wish to carry in the bag proper. The bag, as well as the suit, is made of waterproof cloth. It may be made to suit the purchaser as to shape, size and material.

A Motion-picture Camera of Radical Design

WHILE engaged in professional work in the jungles of Africa, Carl E. Akeley of the American Museum of Natural History, employed a conventional type of motion-picture camera with more or less success. Because of its wooden case, great weight, bulky tripod, the necessity of using it in conjunction with its tripod, and other common characteristics, he found himself seriously hampered in the filming of wild animal life. On his return to New York he set upon the problem of evolving a motion-picture camera that would meet the requirements of the explorer or the traveler—in a word, he planned to place the cinematograph camera in the hand camera class.

The result of his work is a motion-picture camera of radical design. Perhaps its greatest point of variance from conventional practice is the suspending of the camera proper by a ball-and-socket joint. The joint may be freed or tightened, and serves automatically to level the camera, irrespective of the adjustment of the tripod legs. This feature is one of great importance, since much time and trouble is necessary to level the ordinary camera which is rigidly supported at its bottom on an adjustable tripod head.

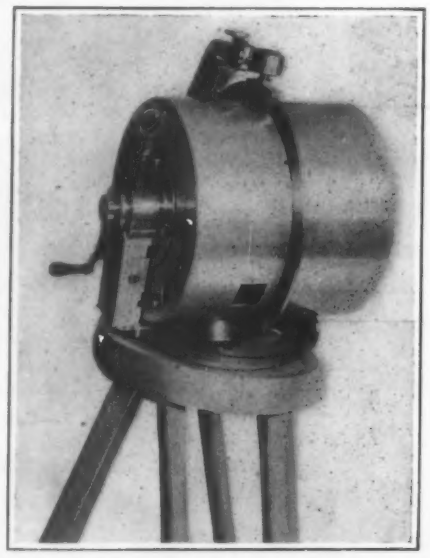
The new camera and its panorama head are made as one unit, permitting the removal of the camera from the tripod and enabling its employment as a hand camera. It can also be set upon a rock or stump and used with the same facility as the ordinary motion-picture camera mounted upon its tripod.

Being made entirely of aluminium, the camera weighs but 20 pounds. The elimination of the wooden case makes it ideal for use in tropical climates, where trouble is often encountered in the warping or cracking of wooden camera cases. The panoramic device permits of both horizontal and perpendicular motion. It is simple and positive and does away with the awkward simultaneous turning of two handles, as required in other cameras.

A small spring motor attached to the belt of the operator and connected to the camera by means of a flexible drive, cranks the camera when it is being used in the hand. This insures steadiness to the pictures taken, which would not be possible if the camera were being cranked by hand. The novel suspension of the camera steadies it to such an extent that it may be used in conjunction with a very light tripod, with full assurance that the pictures will be absolutely steady.

Copyright by Gorodess.

A hand-bag convertible into a life-preserver.



Front view of the cinematograph camera with the lens pointing downward.

Spring cranking motor attached to operator's belt.

Subjecting freight cars to a shower bath enables a western railroad to locate leaks, which are chalk marked and subsequently repaired.

Giving Freight Cars Shower-baths to Locate Leaks

TO detect leaky roofs of freight cars and make repairs that prove immune to further trouble is no easy matter. A supposedly repaired roof has often caused considerable damage to goods in transit, with the result that the railroad company pays the bill, which bill often amounts to considerable in the course of a year's time.

To overcome this difficulty freight cars sent to the shops of the Santa Fé road for repairs are put through a severe test for leaky roofs. A special shower-bath arrangement has been devised and the cars of the company are run under the apparatus at a slow speed. Leaks discovered by the first test are plainly chalk marked by the inspector. A car thus marked is sent to the shop to have its treacherous roof made waterproof, and before it is sent out to resume its work it is subjected to a second test to determine whether the work has been satisfactorily and thoroughly performed.

Enormous volumes of water are poured upon the thousands of cars subjected to this test, and so great is the volume with its resultant force that leaks inside of the sheathing or ends of the cars are often detected.

The valve controlling the water pressure and other mechanism is housed under a shelter in the yards, conveniently located to the siding. According to Charles N. Swanson, superintendent of the car shops at Topeka, the road finds the time and money well spent as insurance against wet damages caused by leaky roofs. The device was originated in the shops of the company.

Membership of the Naval Advisory Board of Inventions

THE Secretary of the Navy has announced the following membership of the Naval Advisory Board of Inventions:

Chairman—Thomas Alva Edison.

Nominated by the American Chemical Society: W. R. Whitney, Schenectady, N. Y. Massachusetts Institute of Technology, '90. Director of Research Laboratory of the General Electric Company, where he has been the moving spirit in the perfection of metallic electric lamp filaments and the development of wrought tungsten. L. H. Baekeland, Yonkers, N. Y. University of Ghent, '82. In private practice. Founder of the Nepera Chemical Company, 1892, inventor of photographic paper and of electric insulating materials.

By the American Institute of Electrical

(Concluded on page 278.)

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

GARTER.—E. B. WINTERS, 815 Union St., Coffeyville, Kan. In a former form and applications for Letters Patent, Mr. Winters employed a bifurcated shield in connection with an inelastic leg band and this is retained in the present one, but he dispenses with the said shield and forms the webbing of the band into the equivalent of the shield, thereby producing a lighter, cooler, and more economical garter, wherein the possibility of separation of parts is practically eliminated, as the band from the shield in the older forms.

CLIP.—W. RODECK, 811 Madison St., New Durham, N. J. This invention provides a clip for use on pockets of overalls, coats, vests and other garments, and more especially designed for holding an ordinary two-foot carpenter's rule securely in position and for allowing ready withdrawal of the rule whenever desired for use.

Pertaining to Aviation.

SAFETY CONTROLLING APPARATUS FOR AEROPLANES.—T. M. DANIELS, 234 South La Salle St., Chicago, Ill. The invention provides a machine with propellers having adjustable blades and disposed with their axes normally vertical, but free to swing in planes crossing the general plane of rotation of the propeller blades, and separate mechanisms, one controllable by hand at the will of the operator, and the other automatically by movement of a weight carried by the machine for shifting the positions of said propellers in order to correct the position of the entire machine.

FLYING MACHINE.—C. G. WALKER, Bramwell, W. Va. The main object here is to provide a device which closely imitates the flight of birds where each wing travels a path in its movement along a parabolic curve, from front to rear, thus causing a swirling current of air beneath each wing, which swirling current is forced rearwardly with respect to the bird, and the bird is propelled forwardly with respect to such current. The inventor has sought to imitate these swirling air currents by mechanical means, which means forms the basis of the present application for patent.

Electrical Devices.

MOLD FOR GLASS SPARK PLUGS AND CORES.—H. LONG, care of Long Bros., Kokomo, Ind. The invention provides a mold in which glass spark plugs or glass spark plug cores may be made accurately and in a minimum of time. It also provides a device in which the conducting members, such as the wires for the terminals, may be centered and held in position during the molding operation.

Of Interest to Farmers.

CHICKEN BROODER.—C. S. BORDNER, Circleville, Kan. The brooder is easily transported and may be used in the open air or in a room, and wherein a base is provided separate from the casing to permit the easy cleaning of the device as a whole, and wherein simple and inexpensive regulating mechanism is provided for controlling the temperature.

Of General Interest.

SEWER CONSTRUCTION.—W. B. GRAY, 1327 South 22nd St., Louisville, Ky. The inventor provides a conduit of molded blocks arranged in such manner as to provide a maximum of resistance to stress in any direction, wherein a series of constructor blocks is provided, so arranged that they may be laid to form a self-supporting arch or curved wall, and a series of key blocks connected with the constructor blocks in such manner as to lock the constructor blocks against movement in any direction with respect to each other.

Hardware and Tools.

LAWN MOWER SHARPENER.—C. F. JUDSON, care of Idaho Title and Trust Co., 826 Main St., Boise, Idaho. This device is attached to the ordinary mower and means permit the former to be attached to any mower regardless of the width of the cut, and has a plurality of engaging surfaces and arranged so that either of said surfaces may be brought into action, and wherein the sharpening action takes place as the mower is run over the ground in the ordinary manner of cutting the grass.

Household Utilities.

DUSTER.—A. G. BARRON. Address Wm. V. Barry, 154 Clifton Place, Brooklyn, N. Y., N. Y. The invention provides a duster which may be laundried; provides means for readily and easily detaching the duster portion and handle therefor; provides a convenient and substantial means for constructing the wiping body of a duster; and provides a duster having a wiping body constructed from cord ends.

Machines and Mechanical Devices.

ASPHALT CUTTER ATTACHMENT FOR STEAM ROLLERS.—C. J. SCHULZ, 1749 Amsterdam Ave., New York, N. Y. The invention deals more particularly with an attachment for the small or steering roller of the machine, whereby such roller can be converted for use as a cutter, as where strips of the asphalt pavement must be cut out for allowing trenches to be dug for pipes and the like, or for repairing the pavement or for use as a roller in smoothing and compressing asphalt in repairing or laying a pavement.

HOISTING ENGINE CONTROL.—W. J. LILLY, 810 W. Galena St., Butte, Mont. This invention relates to the control of hoisting engines and parts associated therewith, the purpose being to prevent overspeeding of the hoisting mechanism carrying the skip or cage. The invention comprehends improved mechanism controllable by the speed of the hoisting mechanism, for shutting off the power of the hoisting engine and for applying the brake mechanism.

Prime Movers and Their Accessories.

CARBURETER.—A. J. HIPPEL, 812 8th Ave., Brooklyn, N. Y., N. Y. This invention provides a new and improved carbureter arranged to insure a thorough and intimate mixture of the gas and air to allow convenient adjustment for admitting the gas and air in the proper proportions, to insure the formation of a mixture of a high explosive power.

Railways and Their Accessories.

MEANS FOR JOINING RAILWAY RAILS.—T. M. DANIELS, 208 South La Salle St., Chicago, Ill. The invention relates to means for joining rails on continuous railway tracks, and one of the main objects thereof is to provide means for connecting the adjacent ends of rails together without the use of bolts or nuts now generally employed. Among other objects, one is to provide such rail connecting means which are maintained in positive engagement with the rails by automatically taking up any looseness or slackness which may be caused by wear due to the vibration of the parts.

DROP-DOOR MECHANISM.—C. E. WICKERSHAM, 7853 North Broadway, St. Louis, Mo. This improvement is designed for embodiment in gondola cars and the like and relates particularly to a drop-door mechanism so constructed and arranged as to provide for either a side discharge or a center discharge of the load, as may be desired.

RAILWAY PACKAGE TRANSFERRING DEVICE.—E. B. HARRAL, 300 Magazine St., New Orleans, La. The more particular purpose of the invention is to provide a mechanism whereby the delivery of the package is accomplished with a minimum of risk, and in which the momentum or inertia of the package is gradually overcome by aid of an inclined surface, or by causing the package to slide upon a surface properly curved to check the relative motion of the package.

RAILWAY STATION INDICATOR.—C. W. GROENING, 1714 Madison St., Ridgewood, Brooklyn, N. Y., N. Y. The invention provides means for displaying the names of successive stations; provides means for adjusting the medium on which the names of the stations are placed to register with the structural peculiarities of the roadbed; provides means for reversing the feed of an announcement ribbon with which the indicator is provided; and provides means for insuring the effective engagement of the ribbon-shifting device and the roadbed device.

INJECTOR FOR LOCOMOTIVE TENDERS.—W. B. SMITH, Box 497, Parkesburg, Pa. In the present patent the invention relates to improvements in water scoops for locomotive tenders, and has for an object the provision of an improved arrangement with means for actuating these scoops and for controlling and regulating the water as it enters and leaves the tender.

Pertaining to Vehicles.

SCRAPER FOR VEHICLE WHEELS.—W. T. S. PATE, 950 Bates St., Indianapolis, Ind. In this case the invention relates to scrapers for vehicle wheels, and while admitting of general application is of special adaptability for use upon wagon wheels for the purpose of cleaning mud from the wheels, the action being practically automatic.

TRACTION ENGINE.—A. C. JOHNSON, care of J. H. McCollough, Jr., 57 19th St., San José, Cal. This invention has for its object to provide a traction engine, especially adapted for hauling heavy loads over bad roads, wherein the tractor carries an endless track, which is continuously laid and lifted as the engine moves forward.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

WE wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

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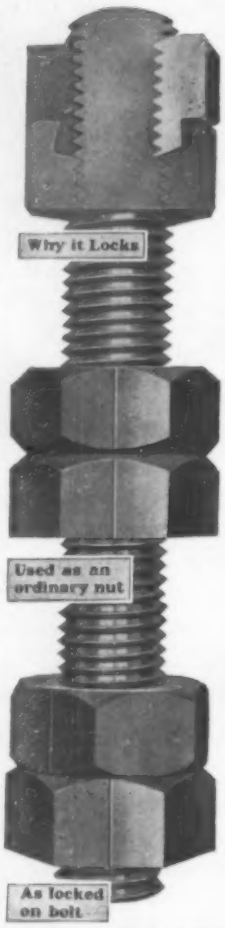

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Further information may be secured and appointment made by addressing

VISLOK, LTD., Care of J. Roland Kay
Room 723, Advertising Bldg., Chicago, Ill.

New Portable Searchlight for Italian Army

(Concluded from page 273.)

seats, three of which are in front, protected by the windshield, and three in the middle of the car, allowing space at the rear for the projector. A permanent top, fitted with curtains, offers shelter to the searchlight crew during rainy weather. The body has four side doors, three sliding and one stationary for the use of the crew, while the searchlight compartment is fitted with three doors, two at the side of the projectors, and the other at the rear. The latter can be taken down so as to permit of the ready removal of the projector. Access to the dynamo for either inspection or repairs can be had through a special door.

The searchlight is supported on its own four-wheeled carriage so that it can be taken off the motor car and wheeled to any location desired. Reinforced wooden base plates are included in the equipment for the supporting of the searchlights on soft ground.

A novel feature of the projector is the use of a rheostat that automatically reduces the current when the iris is being closed, while in order to insure maximum longevity to the silvered surface of the reflector a small electric fan is provided for cooling purposes. Means are furnished for the observation of the arc light on a screen in two directions at right angles.

Control of the searchlight may be effected by hand, or at a distance by means of two motors which alter the direction of the beam, and a third motor for the iris shutter; all the motors being placed on the projector stand and governed from a remote control board connected to them by long cables.

While the use of the remote control safeguards the automobile from the possible artillery fire of the enemy aimed at the projector, the advantages of a hand-operated projector are not lost; for the electrically controlled lamp possesses almost the same flexibility.

The Italian searchlight equipment of this type is furnished either with a 75 centimeter (almost 30 inches) projector, or with a 90-centimeter projector (approximately 35 inches), with candlepowers of 42,000,000 and 60,000,000, respectively. Either sized projector is fitted with a series of aluminium plates which are controlled by a lever and moved together so as to permit of shutting off the light entirely for signaling purposes.

It is claimed that the new searchlight equipment enables the detection of large bodies of troops at night quite as readily and at the same distances as in daylight, while the plant is invisible at only a few yards' distance with the iris shut, even with the searchlight working within at full power.

Membership of the Naval Advisory Board of Inventions

(Continued from page 276.)

Engineers: Frank Julian Sprague, New York city. Naval Academy, 578. Consulting engineer for Sprague, Otis, and General Electric Companies. Founder of Sprague Electric Railway Motor Company, and concerned in establishing first electric trolley systems in the United States. B. G. Lamme, Pittsburgh. Ohio State, '88. Chief Engineer of Westinghouse Electric and Manufacturing Company, and a prolific inventor.

By the American Mathematical Society: Robert Simpson Woodward, Washington, D. C. Michigan, '72. President of Carnegie Institution and an authority on astronomy, geography, and mathematical physics. Arthur Gordon Webster. Worcester, Mass. Harvard, '85. Professor of Physics, Clark University, and an authority on sound, its production and measurement.

By the American Society of Civil Engineers: Andrew Murray Hunt. Naval Academy, '79. New York city. Consulting engineer. Experienced in the development of hydroelectric, steam, and gas plants. Alfred Craven, New York city. Naval Academy, '67. Chief Engineer of

LEGAL NOTICES

PATENTS

If you have an invention which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of more than sixty years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to PATENTS, TRADE MARKS, FOREIGN PATENTS, etc.

All patents secured through us are described without cost to the patentee in the SCIENTIFIC AMERICAN.

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A-B-C OF ELECTRICITY

By

WILLIAM H. MEADOWCROFT

The author explains the various ways by which electricity is obtained and how it is applied. The telegraph, wireless telegraphy, the telephone, electric light as used in arc-lamps and incandescent globes, switches, electric power and batteries, are all treated in separate divisions with the utmost clarity.

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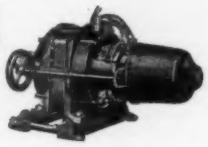

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It is a single phase motor that can be attached to any phase of a polyphase circuit.

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Second best	**15.00**
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Five next best	**5.00 each**
25 next best	**1.00 "**

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Contest Closes Nov. 10, 1915

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Public Service Commission and formerly Division Engineer in charge of construction work on Croton Aqueduct and reservoirs.

By the American Aeronautical Society: Matthew Bacon Sellers, Baltimore, Md. Lawrence Scientific School. Director of Technical Board of the Aeronautical Society of America, and first to determine dynamic wind pressure on arched surfaces by means of "wind funnel." Hudson Maxim, Brooklyn, N. Y. Ordnance and explosive expert and maker of first smokeless powder adopted by the United States Government.

By the Inventors' Guild: Peter Cooper Hewitt, New York city. Inventor of electric lamp, appliances to enable direct current apparatus to be used with alternating current circuits, and devices for telephones and aircraft. Thomas Robbins, Stamford, Conn.; Princeton. President of Robbins Conveying Belt Company and inventor of many devices for conveying coal and ore.

By the American Society of Automobile Engineers: Andrew L. Riker, Detroit. Vice-president of Locomobile Company. Electrical and mechanical engineer and inventor of many automobile devices. Howard E. Coffin, Detroit, Michigan, '96. Vice-president of Hudson Motor Car Company and active in the development of internal combustion engines.

By the American Institute of Mining Engineers: William Laurence Saunders, New York City. Pennsylvania, '76. Chairman Board of Directors, Ingersoll-Rand Company, and inventor of many devices for subaqueous and rock drilling. Benjamin Bowditch Thayer, New York city. Harvard, '85. President of Anaconda Copper Mining Company and an authority on explosives.

By the American Electro Chemical Society: Joseph William Richards, South Bethlehem, Pa. Lehigh, '86. Professor of Electro Chemistry, Lehigh University, and author of numerous works on electro metallurgy. Lawrence Addicks, Chrome, N. J. Massachusetts Institute of Technology, '89. Consulting engineer for Phelps, Dodge & Co., and an authority on the metallurgy of copper.

By the American Society of Mechanical Engineers: William Leroy Emmet, Schenectady, N. Y. Naval Academy, '81. Engineer with the General Electric Company. Designed and directed the development of Curtis turbine. First serious promoter of electric propulsion for ships. Spencer Miller, South Orange, N. J. Worcester Polytechnic, '79. Inventor of ship coaling apparatus and the breeches buoy device used in rescues from shipwrecks.

By the American Society of Aeronautic Engineers: Henry Alexander Wise Wood, New York city. Engineer and manufacturer of printing machinery, student of naval aeronautics. Elmer Ambrose Sperry, Chicago. Cornell, '76. Founder of Sperry Electric Company, designer of electric appliances and gyroscope stabilizer for ships and aeroplanes.

The Largest Hydraulic Motor

OUR attention has been called to the fact that in the description of "The Largest Hydraulic Motor," which appeared in the issue of August 21st, data relating to two entirely different turbines shown at San Francisco were confused. The Pelton-Francis wheel shown in the illustration has a normal rating of 20,000 horsepower, and is capable of carrying an excess load of 25 per cent. This wheel is coupled to a 12,500 kilo-volt-ampere generator, although it is capable of driving one of 15,000 kilo-volt-ampere. The static head under which this turbine works is, on account of pipe line friction, when operating under maximum load, about 485 feet, and the normal water consumption is 375 cubic feet per second.

The makers of this wheel inform us that while this wheel is not the largest, it is the most powerful of its type. The turbines at Cedar Rapids, and at Keokuk, are larger in weight, but are only about half as powerful, while one of a somewhat different type in the Washington Power Company's plant is somewhat more powerful.

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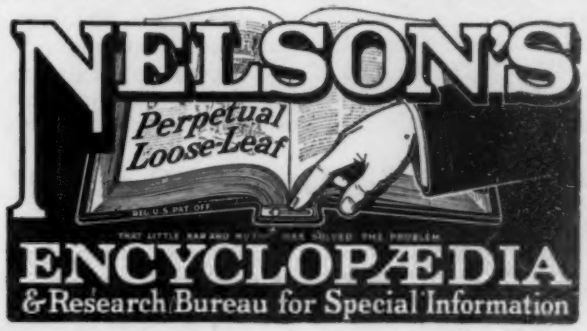

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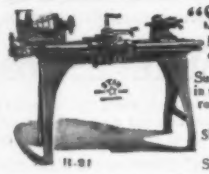
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What the Allies Demand Before They Will Accept Peace

Hilaire Belloc, widely known as Editor of *Land and Water*, whose writings on the War have given him a unique position of authority abroad, will write for THE WORLD'S WORK during the coming Fall. Mr. Belloc's articles will give a survey of the condition on which peace must react and they will be of the highest importance.

Morton Fullerton, for a long time Paris correspondent of the London *Times*, will contribute a series endeavoring to show the aims of the fighting nations. Mr. Belloc and Mr. Fullerton are not the men best known here, but they are the writers who best know these two important subjects.

To understand the new era following the War one must have a fair perspective of the relations of this country with Japan, Mexico and Haiti. Mr. George Marvin, the Washington editor of THE WORLD'S WORK, whose experience in our diplomatic and consular services gives him a personal experience, combined with his broad knowledge, will contribute a series on Our New Foreign Relations.

Theodore H. Price, Editor of *Commerce and Finance*, will contribute a series on the New Era in Commerce and Finance, and Mr. Burton J. Hendrick will contribute a series on The New Government of the United States.

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Notes and Queries.

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(13080) C. R. B. asks: By whom and at what date was electricity first applied to a car to run on a track? What city in the world had the first electric street car system, and what year? In what year was the first electric street car system put into operation in New York? A. In 1835, Thomas Davenport, a blacksmith of Brandon, Vermont, made an electric railway and ran a car around a circular track with passengers. In 1851, C. G. Page ran an electric car from Washington, D. C., to Brandenburg, Md., with a motor and 100 Grove cells as a battery, on the tracks of the Baltimore and Ohio Railroad. In 1879, Siemens and Halske had an electric railway at the exposition in Berlin, Germany. In 1880, Edison had an electric railway at Menlo Park, N. J., which carried passengers. In 1887, Sprague built an electric road in the city of Richmond, Va., 13 miles long. This was the first large electric railway enterprise in America. We doubt if anyone can set the date when an electric vehicle first ran on a dirt or common road. We have not the date when street cars were first run by electricity in New York. It was not until some years after they were used in other places, because New York city would not have the overhead trolley used on its streets.

(13081) J. C. does not give his street address in Brooklyn. We wish to again remind readers that full name and address must be given in all cases, as every query is answered by mail, whether it is published in the paper or not. He asks: Will you kindly give in your SCIENTIFIC AMERICAN an illustrated description of how the large shells from the modern rifles, say from the 5-inch to the 14-inch guns, sink after touching the water, their position at, say 25, 50 and 100 feet under the surface of the sea? A. We beg to say that for lack of any data on the subject, we are unable to tell you what course is taken by the shells after they strike the water. This much, however, is certain: that when they finally penetrate, their course will be influenced by the direction in which they strike, the angle of fall, and other conditions.

(13082) R. W. asks: Will you please tell me how high shooting stars are from the earth? A. Prof. Charles A. Young, in his "Manual of Astronomy," page 458, states that "a meteor usually appears at an altitude of about 80 or 100 miles and disappears at a height of from 5 to 10 miles." We can send you this valuable text book of astronomy for $2.50.

(13083) B. W. H. asks: How far is the influence of, say, an electromagnet of two tons lifting capacity felt? A. Any distance which we might give for the magnetic force of an electromagnet which is capable of lifting two tons to be felt through the air would be merely a guess. We have no experimental data for an opinion. Such a magnet could not lift one ton, half its full load, through an air gap of more than a few inches. By a delicate instrument the lines of force of such a magnet could be traced many feet. Doubling the force of a magnet does not double the distance to which its influence is felt. The intensity of the force varies inversely as the square of the distance. It will require four times the force in order that its intensity shall be felt equally at twice the distance. With twice the force the action would be extended to a little less than 1½ times the distance.

(13084) H. S. S. asks: Would you kindly tell me when Halley's Comet was first seen by the ancients, and the times of its appearance since then? A. The comet now known by the name of Halley was observed by him in 1681. He showed that the comets of 1531 and 1607 had the same orbit as that of 1681, and from this fact he declared the identity of these comets and predicted the return of the comet of 1681 for the year, 1757. It actually passed its perihelion in March, 1759. This difference was due to the attractions of Jupiter and Saturn upon the comet. Halley had made a rough allowance for these attractions in his calculation, but the actual retardation was greater than he had found. It was, however, correctly computed as 618 days by Clairault before the appearance of the comet. Halley was born in 1656, and was 25 years of age when he made his bold prediction that this comet would return in 76 years. Although he lived to the great age of 85 years, he died before his prediction was verified. The earliest record of this comet is in the year 1066, when it was said to have been four times as large as Venus, and to have given one fourth as much light as the moon. The next return noted was in 1456. Then follow the returns in 1531, 1607, 1681, 1759, 1835, 1910. Its orbit has been calculated back to 85 B. C. with certainty, and to 240 B. C. with probability. 2. Tell me the times of the eclipses in 1916. A. We cannot give you the list of eclipses for 1916, since we have not yet obtained our copy of the *Astronomical Ephemeris* for that year. You may be able to get the list from the Director of the Naval Observatory, Washington, D. C. Or you can get a copy of the *Ephemeris* from the Government Printing Office in Washington. It is probably now ready for issue.

NEW BOOKS, ETC.

WHAT IS BACK OF THE WAR? By Albert J. Beveridge. Indianapolis: The Bobbs-Merrill Company, 1915. 8vo.; 430 pp.; illustrated with photographs. Price, $2 net.

No one who seriously desires to understand the attitudes and the beliefs of the warring nations should overlook this unique study by a representative American. It is unique in that it carefully refrains from personal comments and constructions—"a bare record of the facts with earnest effort to state them in just and truthful proportion." Mr. Beveridge has interviewed at length high dignitaries of Germany, France and England; he has discussed the war with business men, scholars, soldiers and the common people in all three countries; and what he gives us is what these diverse types gave him—just as they said it. There is a masterly sketch of the German Emperor that cannot fail to invest him with a new aspect and a new interest in the eyes of most Americans. Admiral von Tirpitz and Field Marshal von Hindenburg both answered Mr. Beveridge's questions with apparent eagerness and sincerity; leaders of thought in France and England were quite as approachable. The effect which this book produces upon the reader may be likened to nothing so much as sitting in a court of law and listening to the conflicting evidence of witnesses, many of them experts. As each gives his apparently authoritative testimony, almost we are persuaded—only to vacillate as succeeding speakers give to the same episodes an entirely different interpretation. The author's final summary of the war's probable effects is tense with suggestion; he believes, for one thing, that the present governmental control of fundamentals for the common good will be retained, in large measure, after the re-establishment of peace.

ARITHMETIC FOR CARPENTERS AND BUILDERS. By R. Burdette Dale, B.M.E., M.E. New York: John Wiley & Sons, Inc., 1915. 12mo.; 240 pp.; 109 figures. Price, $1.25 net.

The author, starting with elementary principles that will be in the nature of a review to eighth-grade students, leads gradually up to the problem of estimating the cost of buildings. Practical applications are recognized and emphasized throughout the text, and the individual judgment of the student is persistently called upon in an effort to perfect it. On no other point is this effort more evident than in the economical use of material. The book may be conveniently used as a text in vocational schools, as a correspondence course, or as an aid to the more experienced worker.

NATION OF NATIONS. The Way to Permanent Peace. A Supreme Constitution for the Government of Governments. By Alfred Owen Crozier. Cincinnati: Stewart & Kidd Company, 1915. 12mo.; 128 pp. Price, 50 cents net.

In suggesting an alternative to the "League of Peace," the author efficiently discloses the weak points of the plan. Whether his own suggestion avoids these weaknesses without incorporating difficulties quite as momentous is another question. The permanent peace plan of the author calls for the disarmament of all nations and their representation in a supreme Government that alone has police power in international disputes, with sufficient force to back their decisions. This Nation of Nations is to determine who is the aggressor and who is the victim. This is sufficiently hard when individuals seek justice in a court of law and the attendant circumstances may generally be unfolded with comparative ease. It would be difficult, indeed, to deal with the infinitely complex and hidden causes leading by their accretion to a violent state of antagonism between nations. However, we may hope that the evolution of the human mind may soon reach that state where its egotism does not blind it to the fact that seldom is one cause entirely just and the opposing cause entirely vicious. When our leading minds attain this emancipation, some such plan as the author's may be adopted with general success. In the meantime, careful studies, such as he gives us, will hasten the day when national boundary lines are not necessarily regarded as firing lines, and conflicting opinions and interests among nations may be handled somewhat as individual differences are now disposed of by our civil machinery.

PRINCIPLES OF DOMESTIC ENGINEERING. Or the What, Why and How of a Home. By Mary Patterson. Colonia, New Jersey: Mrs. Frank A. Patterson. 8vo.; 310 pp.

In this substantial volume of wholesome philosophy, Mrs. Patterson offers her solution of the domestic problem of labor and capital; she seeks to standardize housework, to indicate the manner in which scientific management may revolutionize the home, and to minimize drudgery. Her success in restating the principles of efficiency for the housewife is, on the whole, remarkable. If mild criticism might be ventured, it must be to the effect that the author fails to recognize that drudgery is the chief asset of poverty. For example, in intimating that the puchase of silk underwear at $6 the garment, thus eliminating much of the labor of ironing, would be economy, she overlooks the fact that the average woman is comparatively rich in time, but poor in actual cash. She must always choose drudgery in preference to cash expenditures. However, by studying her budget in accordance with the author's suggestions, by purchasing with intelligence, and by ordering her movements in a systematic way, there is no doubt but that a great portion of this drudgery may be eliminated. There is no woman but might be materially helped toward that ideal home of "virtue, sense and taste," by a thoughtful perusal of Mrs. Patterson's work.

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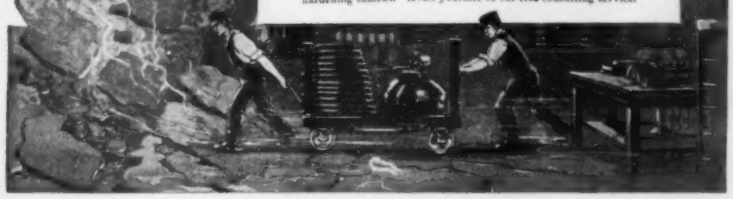

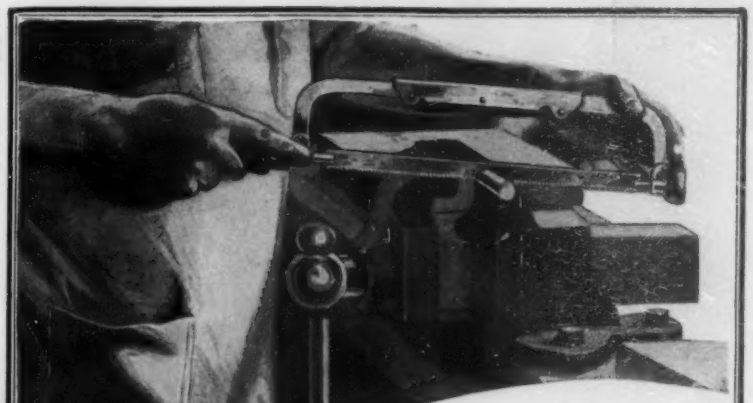

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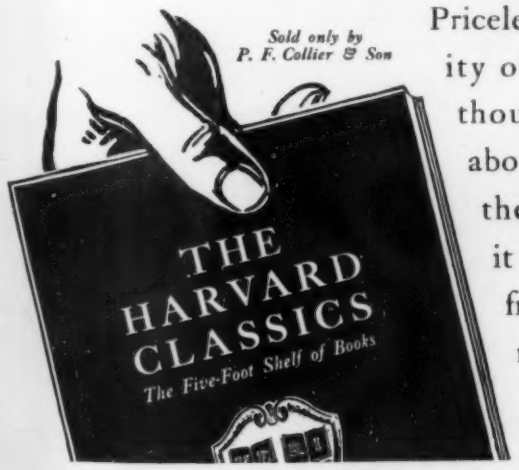

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Arrange now with your dealer to be the first in your town to see and ride in the new Stearns-Knight Eight. Or write for descriptive booklet.

F. B. STEARNS COMPANY, CLEVELAND, OHIO

Stearns Light Four, Knight-Motored, New Series

The Stearns-Knight line also includes the famous Four, the price of which has been reduced to $1395—even with improvements. This car represents all that is surest in the application of the Knight principle because it was the first in America—because it is backed with the longest experience.

A few years ago only rich men could afford Stearns-Knights. Now our new Four costs less than similarly well built cars without the Knight feature. Write for our book about the Light Four.

Specifications of Stearns-Knight Eight

MOTOR—8-cyl. 3¼ in. bore, 5-in. stroke. S. A. E. rating 32.8. Cylinders cast in two blocks of four, set at an angle of 90 degrees. Force Feed lubrication to all bearings.

CLUTCH—Stearns Multiple dry disc.

TRANSMISSION—Selective type, three speeds forward and one reverse. A unit with engine.

DRIVE—Through propeller shaft and one universal joint to rear axle.

REAR AXLE—One piece pressed steel with bevel gear housing mounted in center, making a very rigid construction.

FRONT AXLE—One piece forging, Stearns special design.

SPRINGS—Semi-elliptic front—Cantilever rear.

BRAKES—Foot brake contracting on propeller shaft. Emergency brake expanding, on rear wheels.

TIRES—33x4½ all around.

WHEEL BASE—123 in.

GASOLINE SUPPLY—Tank in rear—Stewart vacuum feed.

EQUIPMENT—Westinghouse starting and lighting system with double bulb headlights and a number carrying tail light, instrument board light and trouble-light attachment. Oil-gauge, gasoline-gauge, electric horn, speedometer, windshield, one-man top, tire carrier, tool kit, and one extra rim.

PRICE—$3950, f. o. b. Cleveland